

3.9 NOISE AND VIBRATION

SYNOPSIS

This section describes current conditions and evaluates potential impacts of noise and vibration from the proposed action and alternatives. Each alternative is examined by major project component: mine site; transportation facilities; and pipeline.

Summary of Existing Conditions:

The ambient sound levels of the region are described in this section with regard to the regulatory framework and noise ordinances of the affected communities. Background information on ambient noise and vibration levels is also presented.

Mine Site: The mine site would be located in a remote region of Alaska characterized as having very little or non-existent development. The baseline ambient sound level for the area where the mine site would be located is shown in Table 3.9-7.

Transportation Facilities: For the purpose of describing existing noise levels, the transportation facilities component of the proposed Donlin Gold Project is grouped as follows: (1) the mine access road (Alternative 2) or Birch Treet Crossing (BTC) Road (Alternative 4) and airstrip; and (2) Dutch Harbor Port, Bethel Port, river traffic, and Angyaruaq (Jungjuk) (Alternative 2) or BTC Port (Alternative 4).

Pipeline: The proposed 315-mile natural gas (Alternative 2) or 334-mile diesel (Alternative 3B) pipeline would originate at an existing 20-inch natural gas pipeline near Beluga (Alternative 2) or Tyonek (Alternative 3B) and would terminate at the proposed mine site. The majority of the area adjacent to the proposed pipeline is undeveloped. However, some areas around the pipeline ROW would have higher ambient noise levels. The location of the proposed compressor station would be in a remote wilderness area west of the City of Anchorage, Alaska, and near the boundary of the Susitna Flats State Game Refuge.

Expected Effects:

A 15-mile radius is used as a reference distance for noise impact in this EIS because it is considered to be a distance beyond which the noise impact is expected to be negligible or no effect. It is conservative as the nearest community to the Project Area is about 10 miles away.

Alternative 1: No Action – This alternative would not affect noise or vibration levels in the EIS Analysis Area. Under the No Action Alternative, the proposed Donlin Gold Project would not be undertaken and the required permits would not be issued. Consequently, there would be no noise or vibration impacts on any sensitive receptors from the implementation of the No Action Alternative.

Alternative 2: Donlin Gold's Proposed Action – Impacts on noise levels would be negligible, with the most perceptible impacts felt at specific sensitive receptors during pipeline construction. The exact noise levels would depend on the number and type of noise sources operating at the same time from the same reference distance. Impacts would be of low intensity for the mine site and transportation facilities due to the distance to the sensitive receptor (Crooked Creek). Higher intensity noise levels could be experienced associated with the Bethel or Dutch Harbor Port sites, and also at Rainy Pass Lodge during pipeline construction, pipe laying and periodic pipeline maintenance. The duration of most noise effects would range from temporary (intermittent impacts associated with construction or closure activities, or specific maintenance events) to long-term (e.g. somewhat perceptible changes in noise levels associated with mine site operations). The geographic extent of impacts would be local, in that impacts would be experienced at sensitive receptors. There are no unique resources, or resources protected by legislation at any of the sensitive receptors, so noise impacts would be considered common in context.

Many aspects of the project components and phases do not utilize major ground-borne vibration-causing equipment. For this study, vibration impacts during pile driving or blasting activities were analyzed as a conservative approach as this equipment is considered to produce major sources of ground vibration for the project. Impacts would be low in intensity at the sensitive receptors, and would be considered temporary in duration (vibration-causing activities would occur intermittently throughout project construction and operations). Net overall effects of Alternative 2 on vibration would be considered no effect to negligible.

Other Alternatives: The effects of other alternatives on noise would be very similar to the effects of Alternative 2. Differences of note include:

- *Alternative 3B (Diesel Pipeline)* – A 19-mile segment between Tyonek and the beginning of the natural gas pipeline route (under Alternative 2) at MP 0 in Beluga would be constructed for the diesel pipeline. This additional segment would cross the Beluga River using HDD. However, there would be no change in existing ambient noise levels associated with HDD activities at Tyonek or Beluga (the nearest sensitive receptors to the Tyonek pipeline segment). Additionally, there would be no blasting or ice road construction and maintenance activities associated with the Tyonek pipeline segment.
- *Alternative 4 (Birch Tree Crossing [BTC] Port)* – Although the port and road configuration would change, and barge traffic would travel shorter distances on the Kuskokwim River, the noise impacts would be similar to Alternative 2. The nearest sensitive receptor under Alternative 4 (City of Aniak) is located 10.7 miles from the BTC Port site and 5.2 miles from the BTC Road, which is far enough away that any noise or vibration impacts produced would not create a perceivable change in existing ambient noise levels.

3.9.1 APPLICABLE CONCEPTS

3.9.1.1 ACOUSTICS PRINCIPLES

Sound is mechanical energy transmitted by pressure waves in a compressible medium (such as air) or incompressible medium (such as water). When sound becomes excessive, annoying, or unwanted, it is referred to as noise. Noise may be continuous (constant noise with uniform intensity), steady (constant noise with fluctuating intensity), impulsive (having a high peak of short duration), stationary (occurring from a fixed source), intermittent (occurring at a fixed rate), or transient (occurring at a varying rate).

Sound pressure can be measured in terms of microPascals (μPa), or microNewtons per square meter ($\mu\text{N}/\text{m}^2$). Because measurements in terms of μPa can be cumbersome, a simplified measurement expressed in decibels (dB) is used. Decibels are calculated by quantifying sound in terms of base-ten logarithmic units of ratios of the sound pressure being measured to a reference pressure squared (called “bel”) multiplied by ten to get “deci-bel,” dB. Typically, the reference pressure is standardized at 20 μPa , or the standard threshold of human hearing.

Sound pressure level (SPL) with respect to a particular source is typically referenced to some distance from that source. As an analogy, a light bulb may give off 100 watts of light whenever it is turned on, but the measured brightness or intensity of the light will depend on the measuring instrument’s distance from the bulb, as well as the conditions of the room the light is in. Noise is similar, in that a source’s sound power is measured in dB, but the sound pressure level measured by a sound level meter will vary with distance from the source and local acoustical conditions.

When the actual sound pressure is equal to the reference pressure, the resulting sound pressure level is 0 dB, but this does not indicate an absence of any sound pressure. For instance, when the standard reference of 20 μPa (the threshold of human hearing) is used, 0 dB would indicate a sound pressure that only the most sensitive of human ears would perceive.

Mathematically, a decibel is defined as ten times the base 10 logarithm of the ratio between the two quantities of sound pressure (SPL)¹ squared, or:

$$\text{SPL} = 10 \log (p/p_o)^2 = 20 \log (p/p_o) \text{ dB}$$

where p is the sound pressure being measured and p_o is the reference sound pressure (standardized at 20 microPascals (μPa), which is the quietest sound that can be heard by most humans - the “threshold of hearing”). SPL attenuates with respect to the inverse distance law, where sound pressure is inversely proportional to the distance from the noise source (FTA 2006; Caltrans 2009).

The A-Weighted Sound Level, expressed as dBA, can be used to quantify sound and its effect on people (EPA 1978). The A-weighted sound level is based on the dB unit, but puts more emphasis on frequencies in the range that humans hear best, and less emphasis on frequencies that humans do not hear well, thus mimicking the human ear. Other weighting scales exist (e.g., B, C, D, E and G) but the EPA recommends the A-weighting scale, as it is convenient and widely used. On the dBA scale, normal conversation falls at about 60 to 65 dBA, and sleep

¹ Sound pressures can be measured in units of microNewtons per square meter ($\mu\text{N}/\text{m}^2$), also called microPascals (μPa): 1 μPa is approximately one-hundred-billionth (1/100,000,000,000) of the normal atmospheric pressure.

disturbance at about 40 to 45 dBA. Table 3.9-1 shows noise levels in dBA for additional common indoor sounds at a representative distances.

Table 3.9-1: Noise Levels from Common Indoor Sources

Noise Source	Noise Levels (dBA)
Jet Flying over at 1,000 feet	100 to 110
Food Processor	93 to 100
Gas Lawnmower at 3 feet	90 to 100
Hair Dryer	80 to 95
Garbage Disposal	76 to 83
Clothes Dryer	56 to 58
Microwave	55 to 59
Quiet Urban Daytime	50
Refrigerator	40 to 43
Quiet Urban Nighttime	40
Computer	37 to 45
Quiet Room	28 to 33
Quiet Rural Nighttime	20 to 30
Grand Canyon at Night (no roads, birds, wind)	10

Notes:

dBA = A-weighted decibel

Sources: NPC 2013, Caltrans 2009.

The following relationships are also helpful for evaluating the impacts of increased exposure to noise (EPA 1974; Caltrans 2009):

- A change of one dBA cannot be perceived by humans, except in carefully controlled laboratory environments.
- Outside of the laboratory, a three dBA change is considered a just-perceivable difference by humans.
- A change in level of at least five dBA is required before any noticeable change in human response would be expected.
- A 10 dBA change is perceived by most humans as approximately a doubling in loudness and can cause an adverse response.

The dBA is an instantaneous measurement of sound pressure. However, a person's perception of sound can be affected by other factors, such as the spatial distribution of the sound source, duration of the sound, the time pattern of the sound, and the time of day of the sound (Caltrans 2009). Some additional factors that affect a person's perception of sound are listed below.

Equivalent Sound Level (L_{EQ}). L_{EQ} represents time-varying A-weighted sound energy as single value for a specific duration (EPA 1978). Thus, a value given in dBA is an instantaneous peak A-

weighted sound value, but a value given in L_{EQ} reflects total A-weighted sound emitted over a specific time period. The L_{EQ} for a 24-hour period is shown as $L_{EQ}(24)$ and the L_{EQ} for a one hour period is $L_{EQ}(1)$. L_{EQ} can also be based on unweighted sound energy, so either the dB or dBA unit description should be presented along with the value.

Day-Night Sound Level (L_{DN}). L_{DN} is based on $L_{EQ}(24)$, but takes into account the time of day of the occurrence of the sound as well as duration and level of the sound. L_{DN} is the A-weighted equivalent sound level for a 24-hour period with an additional 10 dBA weighting imposed on equivalent sound levels during the night (10 p.m. to 7 a.m.).

Table 3.9-2 below shows examples of outdoor day-night noise levels (EPA 1978). For the purpose of describing the affected environment for the proposed Donlin Gold Project, the appropriate L_{DN} values in this table are used to estimate baseline ambient noise levels in project areas where no noise surveys were conducted. Of these industry-standard baselines, the two categories that best fit the locations of the proposed project are rural residential and wilderness ambient.

Table 3.9-2: Examples of Outdoor Noise Levels

Outdoor Location	Noise Levels (L_{DN} in dBA)
Apartment Next to Freeway	87.5
¾ Mile from touchdown at Major Airport	86.0
Downtown with some Construction Activity	78.5
Urban High Density Apartment	78.0
Urban Row Housing on Major Avenue	68.0
Old Urban Residential Area	59.0
Wooded Residential	51.0
Agricultural Crop Land	44.0
Rural Residential	39.0
Wilderness Ambient	35.0

Notes:

dBA = A-weighted decibel

L_{DN} = Day-night sound level, expressed in dBA

Source: EPA 1978

In addition to L_{EQ} , it is often desirable to know the acoustic range of the noise source being measured. This is accomplished through the maximum L_{EQ} (L_{MAX}) and minimum L_{EQ} (L_{MIN}). These values represent the root-mean-square maximum and minimum noise levels measured during the monitoring interval. The L_{MIN} value obtained for a particular monitoring location is often called the acoustic floor for that location.

To describe the time-varying character of environmental noise, the statistical or percentile noise descriptors L_{10} , L_{50} , and L_{90} may be used. These are the noise levels equaled or exceeded during 10 percent, 50 percent, and 90 percent of the measured time interval, respectively. Sound levels associated with L_{10} typically describe transient or temporary events, such as car and truck

passbys. Sound levels are higher than this value only 10 percent of the measurement time. L_{50} represents the median sound level during the measurement interval, and is often—but not always—similar to the L_{EQ} metric. Levels will be above and below this value exactly one-half of the measurement time. L_{90} is the sound level exceeded 90 percent of the time, and is often used to describe background noise conditions. Ninety percent of the time, measured levels are higher than this value, and therefore the L_{90} represents the environment at its quietest periods.

3.9.1.2 GROUND VIBRATION

Ground-borne vibration consists of oscillating motion within the ground. The effects of ground-borne vibration are typically no more than a nuisance; however, at extreme vibration levels buildings may be damaged. Ground-borne vibration can be felt outdoors, but it is typically more of an annoyance to people when they are indoors. The associated effects of a shaking building are more noticeable indoors, where people tend to be moving less and are, thus, more likely to perceive vibration. Induced ground-borne noise is an effect of ground-borne vibration and only occurs indoors, because it is produced from noise radiated from the motion of the walls and floors of a room or the rattling of windows or dishes on shelves.

Vibration velocity levels are quantified using vibration decibels (VdB). Vibration velocity level in decibels is defined as:

$$L_v = 20 \times \log_{10} (V/V_{ref}) \text{ VdB}$$

where L_v is the velocity level in decibels (VdB), V is the root-mean-square velocity amplitude², and V_{ref} is the reference velocity amplitude. A reference must always be specified whenever a quantity is expressed in terms of decibels. The accepted reference quantities for vibration velocity are 1×10^{-6} inches per second in the USA (FTA 2006).

Although the perceptibility threshold is about 65 VdB, a noticeable human response to vibration does not usually occur unless the vibration exceeds 70 VdB. If the vibration level in a residence reaches 85 VdB, most people will be strongly annoyed by the vibration. Human and structural response to different levels of ground-borne noise and vibration are as follows (FTA 2006):

- 65 VdB produces a noise level between 25 (low frequency³) and 40 dBA (mid frequency⁴). This is the approximate threshold of perception for many humans. Low-frequency sound is usually inaudible; mid-frequency sound is excessive for quiet sleeping areas.
- 75 VdB produces a noise level between 35 (low frequency) and 50 dBA (mid frequency). This is the approximate dividing line between barely perceptible and distinctly perceptible vibration-induced sound. Many people find transit vibration at this level annoying. Low-frequency noise is acceptable for sleeping areas; mid-frequency noise is annoying in most quiet occupied areas.

2 Amplitude means the difference between the extremes of an oscillating signal. The root mean square (rms) of a signal is the square root of the average of the squared amplitude of the signal (measured in inch/second).

3 Approximate noise level when vibration spectrum peak is near 30 Hz. The A-weighted noise level will be approximately 40 dB less than the vibration velocity level if the spectrum peak is around 30 Hz.

4 Approximate noise level when vibration spectrum peak is near 60 Hz. The A-weighted noise level will be approximately 25 dB lower if the spectrum peak is around 60 Hz.

- 85 VdB produces a noise level between 45 (low frequency) and 60 dBA (mid frequency). Vibration at this level is acceptable only if there are an infrequent number of events per day. Low-frequency noise is annoying for sleeping areas; mid-frequency noise is annoying even for infrequent events when it affects public uses such as schools, hospitals and churches.
- 100 VdB produces a noise level between 60 (low frequency) and 75 dBA (mid frequency). This is the approximate threshold for minor cosmetic damage in fragile buildings.

Table 3.9-3 shows common vibration sources and estimated vibration velocity levels in VdB at 50 feet from the source. For the purpose of describing the affected environment for the proposed Donlin Gold Project, the appropriate VdB values in this table are used to estimate baseline ambient vibration levels, as no vibration surveys were conducted.

Table 3.9-3: Typical Levels of Ground-Borne Vibration

Vibration Source (50 feet from the source)	Vibration Velocity Level (VdB)
Blasting on Construction Projects	100
Bulldozers and Other Heavy Tracked Construction Equipment	93
Commuter Rail	75 to 85
Rapid Transit	70 to 80
Bus or Truck over Bump	73
Bus or Truck, Typical	63
Background Vibration, Typical	52

Notes:

VdB = Vibration velocity decibel, referenced to 1×10^{-6} inches per second

Source: FTA 2006.

3.9.2 APPLICABLE REGULATIONS

3.9.2.1 REGULATORY FRAMEWORK

The United States Congress enacted the Noise Control Act of 1972 for the purpose of protecting Americans from harmful noise that could jeopardize their health and welfare. In the Noise Control Act, Congress found that “transportation vehicles and equipment, machinery, appliances, and other products in commerce” were major sources of noise. Congress further acknowledged in this act that noise control lies with state and local government, but that federal action is “essential” to deal with major noise sources. Congress subsequently enacted the Quiet Communities Act of 1978 for the purpose of promoting the development of effective state and local noise control programs, to provide funds for noise research, and to produce and disseminate educational materials to the public on the harmful effects of noise and ways to effectively control it.

Under the Noise Control Act and the Quiet Communities Act, the EPA has implemented federal regulations covering standards for major sources of noise such as construction equipment, rail

carriers and motor carriers, or transport equipment⁵ (EPA 2013h). However, there are no federal regulations governing noise in local communities (EPA 2013i); this is left to state and local authorities.

In Alaska, there are no community noise or vibration regulations at the state level. Three communities affected by the proposed Donlin Gold Project (Bethel, the Matanuska-Susitna Borough, and the City of Unalaska) have established noise ordinances at the local level to protect the general public, as described below. There are no local ordinances pertaining to vibration from mining and construction projects for communities affected by the project.

- *Bethel Municipal Code (BMC) 18.32.080 Noise, Rural (R) District.* No loud noise, whether of public or private origin, shall be permitted within this land use district during the hours from 11:00 p.m. to 6:00 a.m. "Loud noise" is defined as a decibel level that exceeds 80 dBA max at the property line of the parcel within the R district that is receiving the noise. This provision applies to all noise sources, whether generated inside or outside the R district, but does not apply to noise associated with aircraft arriving at or departing from the airport or emergency equipment or signals operated by a government agency (BMC 2013).

Matanuska-Susitna Borough Code (MSBC) 8.52.015 Noise, Amplified Sound, and Vibration. The intent of this code is to protect public health and welfare. The borough declared that noise, volume-enhanced sounds and their concomitant vibration are major sources of environmental pollution which represent a present and increasing threat to public peace and to the health, safety, and welfare of the residents of the borough. This provision does not set limits on the sound levels except for those due to the operation of sound-amplifying devices (such as radio, stereo, television, phonograph, loudspeaker, speaker system, amplified drum, amplified musical instrument, sound amplifier) (MSB 2013). The MSBC also includes industry-specific regulations for noise in MSBC 17.28.060 and 17.61.080 which may be applicable to the proposed Donlin Gold Project.

- *Unalaska Code of Ordinances (UCO) 11.08.010 and 020 Nuisances Declared Unlawful and Enumeration of Nuisances; 18.12.090 Harbor Rules - Disturbing the Peace.* The Dutch Harbor port facilities are located in the City of Unalaska. The City of Unalaska prohibits loud or unusual noise caused by operating or using any pile driver, power shovel, pneumatic hammer or other noise-producing apparatus between the hours of 10:00 p.m. and 7:00 a.m. (UCO 2013a). This provision may be relevant to the activities that would be undertaken for the Donlin Gold Project in the vicinity of the proposed Dutch Harbor tank farm. In addition, any person disturbing the quiet enjoyment of other users of the Dutch Harbor port between the hours of 10:00 p.m. and 7:00 a.m. shall be subject to revocation of mooring privileges and shall be required to vacate the port or port facility immediately (UCO 2013b).

Furthermore, the following federal regulatory requirements relevant to noise and vibration may be applicable to the proposed project:

⁵ Standards for transportation equipment and interstate rail carriers are in 40 CFR Part 201, for motor carriers engaged in interstate commerce in 40 CFR Part 202, for low noise emissions products in 40 CFR Part 203, for construction equipment in 40 CFR Part 204, and for transportation in 40 CFR Part 205.

- *Title 30 CFR 816.67*. Mineral Resources, Use of Explosives: Control of adverse effects (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement); and
- *Title 40 CFR Part 204*. Noise Emission Standards for Construction Equipment (EPA).

Additional regulations and guidance in effect to protect fish and wildlife that may be applicable to the proposed project include:

- Alaska Department of Fish and Game (ADFG) *Fish Habitat Permit* and *Alaska Blasting Standard for the Proper Protection of Fish* (Timothy 2013) for blasting activities in or adjacent to fish-bearing water bodies (authorized under Alaska Statute (AS) 16.05.841-871);
- ADFG regulations for any activity that disturbs wildlife in a Special Area (e.g., Susitna Flats State Game Refuge and the Yukon Delta National Wildlife Refuge) (ADF&G 2013g); and
- Marine Mammal Protection Act (MMPA) *Incidental Harassment Authorization* (IHA) or *Letter of Authorization* (LOA) for acoustic harassment of marine mammals, which could apply to construction activities at Tyonek dock or shipping activities in the transportation corridor.

3.9.2.2 GUIDANCE ON AMBIENT NOISE AND VIBRATION LEVELS

Guidance on safe noise levels, which can be used to assess impacts of a project on public health and welfare, is available from EPA (1974, 1978). Table 3.9-4 shows outdoor and indoor noise levels identified by EPA to protect public health and welfare, expressed as $L_{EQ}(24)$ or L_{DN} (based on the dBA over a 24-hour period). Note that the acceptable noise levels listed in the table are not “peak” but are 24-hour averages over several years. These values are not standards, but are levels where the general population would not be expected to be at risk from the identified effects of the noise (EPA 1978).

Table 3.9-4: Yearly Values that Protect Public Health and Welfare with a Margin of Safety

Effect	Safety Level	Area
Hearing Loss	$L_{EQ}(24) \leq 70$ dBA	All areas
Outdoor Activity Interference and Annoyance	$L_{DN}(24) \leq 55$ dBA	Outdoors in residential areas and farms, and other outdoor areas where people spend widely-varying amounts of time, and other places in which quiet is a basis for use.
	$L_{EQ}(24) \leq 55$ dBA	Outdoor areas where people spend limited amounts of time, such as school yard, playgrounds, etc.
Indoor Activity Interference and Annoyance	$L_{DN} \leq 45$ dBA	Indoor residential areas
	$L_{EQ}(24) \leq 45$ dBA	Other indoor areas with human activities, such as schools, etc.

Notes:

dBA = A-weighted decibel

$L_{EQ}(24)$ = Equivalent sound level for 24 hour period, expressed as dBA

L_{DN} = Day-night sound level, expressed as dBA

Source: EPA 1978.

The Federal Transit Administration (FTA) has published guidelines for assessing the impacts of ground-borne vibration associated with construction of rail projects. These guidelines may be applied to other types of projects in assessing their vibration impacts. The FTA-recommended vibration standards are expressed in terms of the vibration level VdB. VdB is calculated from the peak particle velocity (PPV)⁶ measured from ground-borne vibration. The FTA measure of the threshold for human perception is 65 VdB, which correlates to a PPV of about 0.0018 inches per second⁷. The FTA measure of the threshold of architectural damage for conventional sensitive structures is 100 VdB, which correlates to a PPV of about 0.1 inch per second (see Section 3.9.1.2) (FTA 2006). Table 3.9-5 shows acceptable levels of ground-borne vibration velocity for certain land use categories with respect to human annoyance, and Table 3.9-6 shows acceptable levels with respect to building damage.

Table 3.9-5: Acceptable Ground-Borne Vibration Levels with Respect to Human Annoyance

Land Use Category	Acceptable Ground-Borne Vibration Velocity Levels (VdB)		
	Frequent Events ¹	Occasional Events ²	Infrequent Events ³
High Sensitivity - Buildings where vibration would interfere with interior operations	65	65	65
Residential – Residences and buildings where people normally sleep	72	75	80
Institutional – Institutional land uses with primarily daytime use	75	78	83

Notes:

1 "Frequent Events" are defined as more than 70 vibration events of the same source per day.

2 "Occasional Events" are defined as between 30 and 70 vibration events of the same source per day.

3 "Infrequent Events" are defined as fewer than 30 vibration events of the same source per day.

VdB = Vibration velocity decibel, referenced to 1×10^{-6} inches per second

Source: FTA 2006.

Table 3.9-6: Acceptable Ground-Borne Vibration Levels with Respect to Building Damage

Building Category	PPV (inches per second)	Approximate Acceptable Vibration Velocity Level (VdB)
Reinforced concrete, steel, or timber (no plaster)	0.5	102
Engineered concrete and masonry (no plaster)	0.3	98
Non-engineered timber and masonry buildings	0.2	94
Buildings extremely susceptible to vibration damage	0.12	90

Notes:

PPV = Peak particle velocity rms = root mean square VdB = Vibration velocity decibel, referenced to 1×10^{-6} inches per second

Source: FTA 2006.

⁶ The peak particle velocity (PPV) is defined as the maximum instantaneous positive or negative peak of the vibration signal. PPV is commonly referred to as vibration velocity amplitude and is often used in monitoring of blasting vibration since it is related to the stresses that are experienced by buildings.

⁷ As calculated using the equation $L_v = 20 \times \log_{10} (V/V_{ref})$ (see Section 3.9.1.2).

3.9.3 AFFECTED ENVIRONMENT

The ambient sound level of a region is defined by the total noise generated within the specific environment, and is usually comprised of sound emanating from natural and artificial sources. At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of each day and throughout the week and year. This variation is caused not only by variation in noise source activity, but also by changing weather conditions and the effects of seasonal vegetative cover.

No vibration baseline monitoring was conducted for the proposed Donlin Gold Project. The various project components (the mine site, transportation facilities, and pipeline) are located in remote regions of Alaska with very little development and where no major sources of vibration exist within the immediate vicinity. Therefore, a typical background vibration level of 52 Vdb or lower is assumed as baseline vibration level for all project categories. This is below 65 VdB – the threshold of perception for humans (see Table 3.9-3 and Section 3.9.1.2) (FTA 2006).

Existing noise levels for each of the proposed project components are discussed below. A 15-mile radius is used as a reference distance for noise impact in this EIS because it is considered to be a distance beyond which the noise impact is expected to be negligible or have no effect. It is conservative as the nearest community to the project is approximately 10 miles away.

3.9.3.1 MINE SITE

The mine site would be located in a remote region of Alaska characterized as having very little or non-existent development. No actual baseline noise data were collected in the vicinity of the proposed mine site. However, data on ambient noise levels for generic land use types are available, as shown in Table 3.9-2. These values can be used to estimate the baseline ambient sound level for corresponding land use types in the EIS Analysis Area. The existing land use in the vicinity of the proposed mine site corresponds to the “wilderness” classification in Table 3.9-2. The baseline ambient sound level for the area where the mine site would be located is shown in Table 3.9-7.

Table 3.9-7: Baseline Ambient Sound Level of Mine Site Infrastructure and Processes

Donlin Gold Project Component	Baseline Ambient Sound Level (dBA)	Basis
Area of proposed open pit mine, milling and ore processing, waste treatment facility (tailing storage facility), waste rock facility and overburden stockpile, power plant, utilities, services and infrastructure, mine maintenance and safety controls	35 L _{DN}	Typical L _{DN} for Wilderness (EPA 1978), L _{DN} for Outdoor Locations

Notes:

L_{DN} = Day-night sound level, expressed as dBA

Source: EPA 1978.

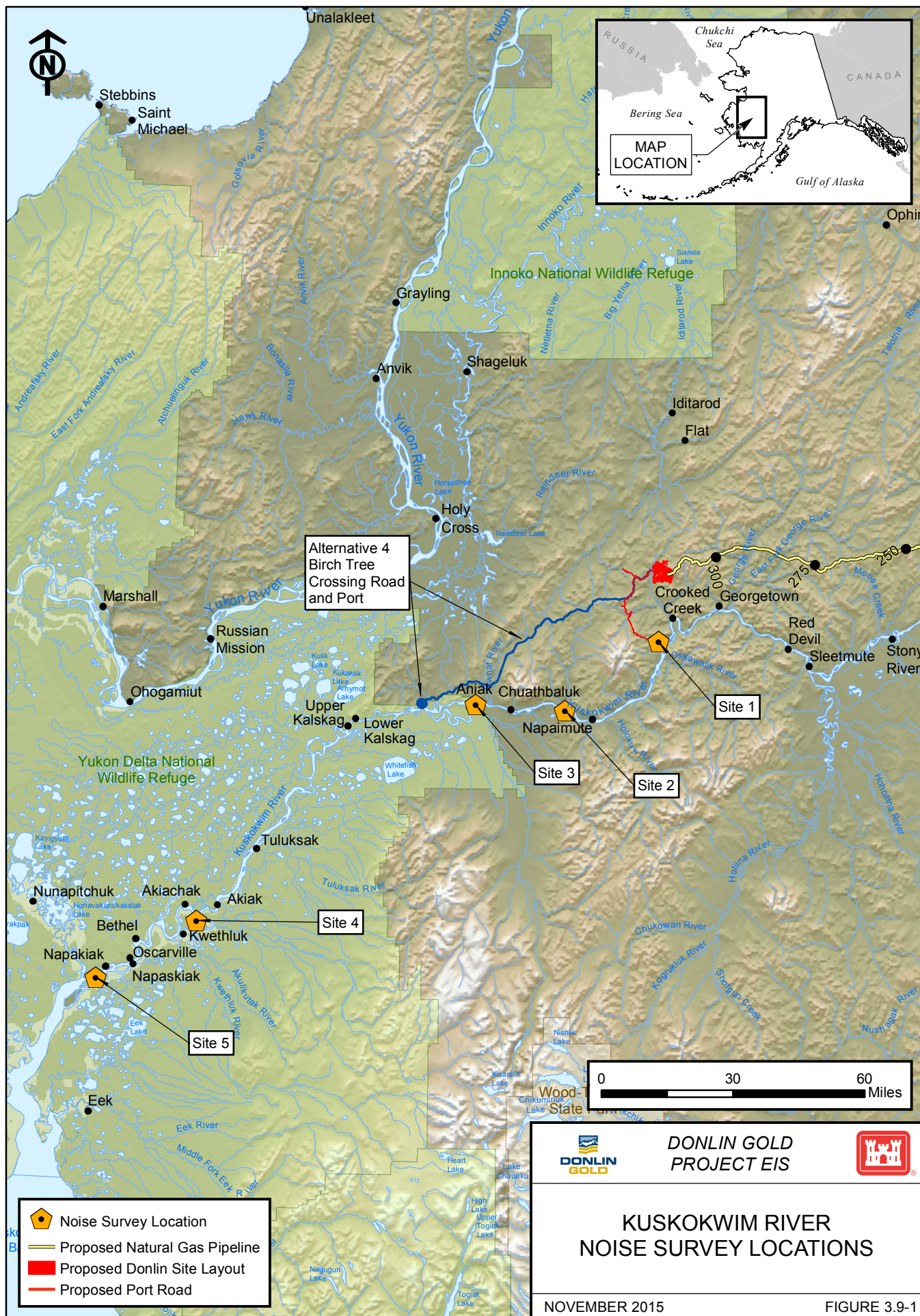
For purposes of comparison, National Park Service (NPS) staff measured outdoor sound levels at a variety of geographically and biologically representative regions of Denali National Park. In its Denali National Park *Acoustic Monitoring Report – 2008* (NPS 2009), NPS indicates that measured L₅₀ for a set of five monitored areas ranged from 23.1 dBA to 41.4 dBA, depending on

acoustical contributors such as proximity of water flows and frequency of aircraft overflights. Assuming these monitored wilderness-type locations have geographic and biologic (e.g., vegetative ground cover and terrain) similarity to the mine site area, if 32 dBA were to represent an arithmetic average of these L_{50} values and if L_{50} were to be considered essentially equivalent to L_{EQ} in these cases, then the corresponding calculated L_{DN} would be 38 dBA and thus comparable (i.e., within 3 dBA) to the presented L_{DN} value in Table 3.9-7.

3.9.3.2 TRANSPORTATION FACILITIES

For the purpose of describing existing noise levels, the transportation facilities components of the proposed Donlin Gold Project are grouped according to location and use, as follows: (1) the mine access road and airstrip; and (2) Dutch Harbor port, Bethel Port, river traffic, and Angyaruaq (Jungjuk) or BTC port, as shown in Figures 2.3-8 and 2.3-41, Chapter 2, Alternatives.

- *Mine Access Road (Alternative 2) or BTC Road (Alternative 4) and Airstrip.* As with the mine site, the area where the airstrip and the majority of the mine access road would be located is remote with very little development. No actual ambient sound data were collected in the near vicinity of the airstrip and most of the proposed mine access road route options. The existing land use in the vicinity of the proposed airstrip and most of the mine access road (except for the portion of the mine access road close to either port site on the Kuskokwim River) corresponds to the “wilderness” classification in Table 3.9-2. Areas closer to the river are expected to have higher ambient noise levels due to boat traffic; therefore, baseline ambient sound levels on the mine access road within sound distance of the Kuskokwim River would be reflected by the sound levels at the Angyaruaq (Jungjuk) (Alternative 2) or BTC port (Alternative 4), as described below. The baseline ambient noise levels for the mine access road and airstrip are summarized in Table 3.9-8.
- *Bethel Port, River Traffic, and Angyaruaq (Jungjuk) (Alternative 2) or BTC Port (Alternative 4).* Permanently inhabited villages and seasonally inhabited camps exist along the river from the mouth of the Kuskokwim River near Bethel to both proposed sites for a river port. The Kuskokwim River serves as a primary transportation corridor during most of the year. Heaviest use of river transportation occurs in summer; this includes commercial barge traffic and small boats. During winter, the frozen river serves as a transportation corridor for snow machines, off-highway vehicles, and light-duty passenger vehicles such as cars and pickup trucks. No motorized vehicles or boats are expected during shoulder seasons of freeze-up and breakup. Airspace along the corridor is used by commercial and general aviation aircraft.
- Baseline noise data for 2005 are available for five sites along the Kuskokwim River (Mullins 2005). The locations of these sites are shown in Figure 3.9-1, and a description of each site along with associated ambient sound is provided in Table 3.9-8. These data can be used to describe the baseline ambient sound level for the areas where the Bethel Port and Angyaruaq (Jungjuk) or BTC port would be located, and where river traffic along the Kuskokwim River between the Bethel Port and the Angyaruaq (Jungjuk) or BTC Port would be affected by the proposed project.



DONLIN GOLD
PROJECT EIS



KUSKOKWIM RIVER NOISE SURVEY LOCATIONS

NOVEMBER 2015

FIGURE 3.9-1

- *Dutch Harbor Port.* The Dutch Harbor area of Unalaska, Alaska is on Amaknak Island includes most of Unalaska's population (NOAA 2005). No actual ambient sound data was collected in the vicinity of the Dutch Harbor Port. Given that Dutch Harbor is mainly an industrial port area, and is located in a relatively populated area, the baseline noise level in the vicinity corresponds to the "Old Urban Residential Area" classification at 59 dBA in Table 3.9-2.

Table 3.9-8: Baseline Ambient Sound Data for Transportation Facilities

Donlin Gold Project Component	Baseline Ambient Sound Level (dBA)	Basis
Area of Mine Access Road and Airstrip	35 L_{DN} This sound level is comparable to the sound level of a very quiet room fan at low speed at a 3-foot distance.	Typical L_{DN} for Wilderness (EPA 1978), L_{DN} for Outdoor Locations
Port/River Traffic from Angyaruaq (Jungjuk) Port to Napaimute	47 L_{DN} (49 max $L_{EQ}(1)$) This sound level is comparable to a refrigerator at a 3- foot distance or a bird twitter outside at a 50- foot distance	<p>Study Site 1 - Located at Jungjuk Creek, proposed location of mine's barge dock, on a sparsely populated section of river about seven miles downriver (nominally south) of Crooked Creek. Site chosen because this would be a major hub of activity. The sound levels were recorded about 40 feet from river bank.</p> <p>Data collected July 7, 2005 1500 hours to July 8, 2005 1500 hours. The hours with helicopter noise are omitted from L_{DN} calculations because the helicopters are associated with the mine (Mullins 2005, page 3) and are not otherwise typical of the area. The L_{DN} of 47 dBA is revised from Mullins' study. It was calculated assuming the L_{EQ} is the average of the hour before and the hour after for all hours with helicopter noise (i.e. for 0700, the assumed L_{EQ} is 38.0; for 1000, the assumed L_{EQ} is 37.0; and for 1800, the assumed L_{EQ} is 39.5). Similarly the helicopter hours are omitted from determination of L_{MAX}.</p> <p>Observer Comment: <i>Jungjuk Creek experiences occasional distant aircraft flyovers, with levels up to 58 dBA. There was an average of two small boat passbys per hour, with maximum levels of 58 dBA. No barges or other unusual traffic were observed passing this site during the measurement period.</i></p>

Table 3.9-8: Baseline Ambient Sound Data for Transportation Facilities

Donlin Gold Project Component	Baseline Ambient Sound Level (dBA)	Basis
River Traffic from Napaimute to Chuathbaluk	62 L _{DN} (63 max L _{EQ} (1)) This sound level is comparable to noisy lawn mower at 33- foot distance.	Study Site 2 - Located about halfway between the villages of Napaimute and Chuathbaluk. This site was chosen to capture the typical boat traffic levels traveling between small river villages. The sound levels were recorded about 50 feet from river bank.
		Data collected July 9, 2005 2100 hours to July 10, 2005 2100 hours. The L _{DN} of 62 dBA is revised from Mullins' study. It was calculated assuming the L _{EQ} is the average of the hour before and the hour after for all hours with missing data (i.e. for 1100 through 1700 hours, the assumed L _{EQ} is 51.6). <i>Observer Comment: Small boats made momentary sound levels of up to 56 dBA. This site experienced only occasional distant aircraft flyovers and roughly one boat per hour passing by the monitor location. Weather conditions may have minimized the number of small boats, however. It became very windy during this 24-hour measurement. Much of the noise that was recorded was simply waves on the shore and wind in the trees along the riverbank. Several hours were deemed invalid due to excess wind speed, above 15 knots. However, the sound data shows that early morning hours were calm, so adequate information was collected for the quietest times at night.</i>
River Traffic from Chuathbaluk to Kalskag (including BTC Port)	53 L _{DN} (60 max L _{EQ} (1)) This sound level is comparable to noise from normal conversation or clothes dryer within a 10- foot distance.	Study Site 3 - Located across the river from the Aniak airport and the confluence of the Aniak River where it joins the Kuskokwim River. The far side of the river was chosen to avoid over-emphasizing aircraft noise. A spot across from the Aniak River was chosen because it would capture the small boat traffic associated with both traffic corridors. The sound levels were recorded about 50 feet from river bank.
		Data collected July 8, 2005 1900 hours to July 9, 2005 1900 hours. <i>Observer Comment: Conditions were also windy for a portion of this 24-hour period, with an estimated average wind speed of 7-8 knots and peaks up to 17 knots. River conditions were quite rough, although several small boats were observed traveling both up and down river. Small boat traffic is estimated at 3 boats per hour passing this site. Two barges also passed the site almost simultaneously at 1850 hours [on July 9, 2013], one in each direction. Aircraft traffic is estimated at about three planes per hour to/from the Aniak airport, but this might be a low number due to the wind conditions.</i>
River Traffic from Kalskag to Kwethluk	52 L _{DN} (58 max L _{EQ} (1)) This sound level is comparable to noise from normal conversation or clothes dryer within a 10- foot distance.	Study Site 4 - Located on the lower Kuskokwim River between Kwethluk and Akiak. The specific site chosen was the intersection of the main river channel and the loop that passes by Kwethluk village, so that all river traffic had to pass by this point. The sound levels were recorded about 45 feet from river bank.
		Data collected July 11, 2005 1400 hours to July 12, 2005 1400 hours. <i>Observer Comment: This is also the point where two passes of the hovercraft were observed. There was noticeably more aircraft traffic passing through the area, since it is only a few miles upstream from Bethel and lies along the main aircraft approach route from upriver destinations.</i>

Table 3.9-8: Baseline Ambient Sound Data for Transportation Facilities

Donlin Gold Project Component	Baseline Ambient Sound Level (dBA)	Basis
Area of Bethel Port/River Traffic from Kwethluk to Project End	49 L_{DN} (53 max $L_{EQ}(1)$) This sound level is comparable to a refrigerator at a 3- foot distance or a bird twitter outside at a 50- foot distance.	Study Site 5 - Located downriver from Napakiak, near the Johnson River. This is near the previously proposed location of the deep water lightering facility. This facility is no longer part of the proposed action. This specific measurement site was chosen on the west edge of a river island near the deep channel, again so that almost all the river traffic had to pass by the noise monitor location. The sound levels were recorded about 35 feet from elevated river bank.
		Data collected July 13, 2005 1600 hours to July 14, 2005 1600 hours. <i>Observer Comment: About six to eight small boats per hour were passing the site on July 13, 2005; however, there were virtually no small boats traveling past the site the next day. Two barges were observed passing this site, one in the early evening and one in the middle of the night and several general aviation events, estimated at two per hour, during the daytime hours were observed.</i>
Dutch Harbor Port	59 L_{DN} This sound level is comparable to noise from a microwave or clothes dryer within a 10-foot distance.	Typical L_{DN} for old urban residential area - EPA 1978, L_{DN} for Outdoor Locations

Notes:

L_{DN} = Day-night sound level, expressed as dBA

Max $L_{EQ}(1)$ = the maximum $L_{EQ}(1)$ for the 24 hours for which data collected

Sources: EPA 1978; Mullins 2005; NPC 2013; Endpcnoise.com 2014.

3.9.3.3 PIPELINE

The proposed 315-mile natural gas (Alternative 2) or 334- mile diesel (Alternative 3B) pipeline would originate at an existing 20-inch natural gas pipeline near Beluga (Alternative 2) or Tyonek (Alternative 3B), and would terminate at the proposed mine site (Figure 2.3-14, Chapter 2, Alternatives). The majority of the area adjacent to the proposed pipeline is undeveloped. However, some areas around the pipeline ROW-- such as the Rainy Pass Lodge, the confluence of the Talachulitna River and Skwentna River, scattered cabins, primitive airstrips, and the southern terminus of the pipeline would have higher ambient noise levels.

With the exception of the area of the proposed pipeline compressor station, there is no actual baseline ambient sound data for the pipeline component of the Project Area. The ambient noise levels for generic land use types shown in Table 3.9-2 can be used to estimate the existing ambient sound levels for this area. The undeveloped areas are described by the "wilderness" category; while Rainy Pass Lodge, the confluence of the Talachulitna River and Skwentna River, scattered cabins, primitive airstrips, and the southern terminus would be described as "rural residential."

Baseline noise data was collected from September 7, 2011 to February 15, 2012 and April 18, 2012 to July 16, 2012 in the vicinity of the proposed pipeline compressor station. The location of

the proposed compressor station would be in a remote wilderness area west of Anchorage, and near the boundary of the Susitna Flats State Game Refuge. The ambient noise monitoring station was located northeast of the proposed compressor station site as shown in Figure 3.9-2 (ARCADIS 2012c). High-voltage transmission lines, pipeline corridors, gravel roads, and natural gas production wells and associated equipment are found within 5 miles of the location of the proposed compressor station. The nearest potential sources of noise include an oilfield access road located 2 miles to the west-southwest, and a natural gas production pad and gravel road located roughly 3 miles east.

Baseline ambient noise levels for the pipeline component are shown in Table 3.9-9.

Table 3.9-9: Baseline Sound Data for the Pipeline

Donlin Gold Project Component	Baseline Ambient Sound Level (dBA)	Basis
Area of Majority of Pipeline	35 L_{DN} This sound level is comparable to a very quiet room fan at low speed at a 3-foot distance.	Typical L_{DN} for wilderness - EPA 1978, L_{DN} for Outdoor Locations
Area of Pipeline near Rural Residential Areas	39 L_{DN} This sound level is comparable to a typical living room or a computer within a 3-foot distance.	Typical L_{DN} for rural residential areas - EPA 1978, L_{DN} for Outdoor Locations
Area of Proposed Compressor Station	80 max $L_{EQ}(15)$ This sound level is comparable to an alarm clock next to the receptor or a very loud traffic on an expressway at an 82-foot distance.	Maximum L_{EQ} for Daytime hours (7 a.m. to 10 p.m.), January 18, 2012, Ambient Baseline Noise Monitoring Report for Proposed MP 5 Gasline Compressor Station
	28 to 45 $L_{EQ}(15)$ These sound levels are comparable to a whisper up to noise levels from a normal living room; talking or radio in the background within a 3-foot distance.	Typical sound levels over the course of a year, Ambient Baseline Noise Monitoring Report for Proposed MP 0.4 Gasline Compressor Station

Notes:

L_{DN} = Day-night sound level, expressed as dBA

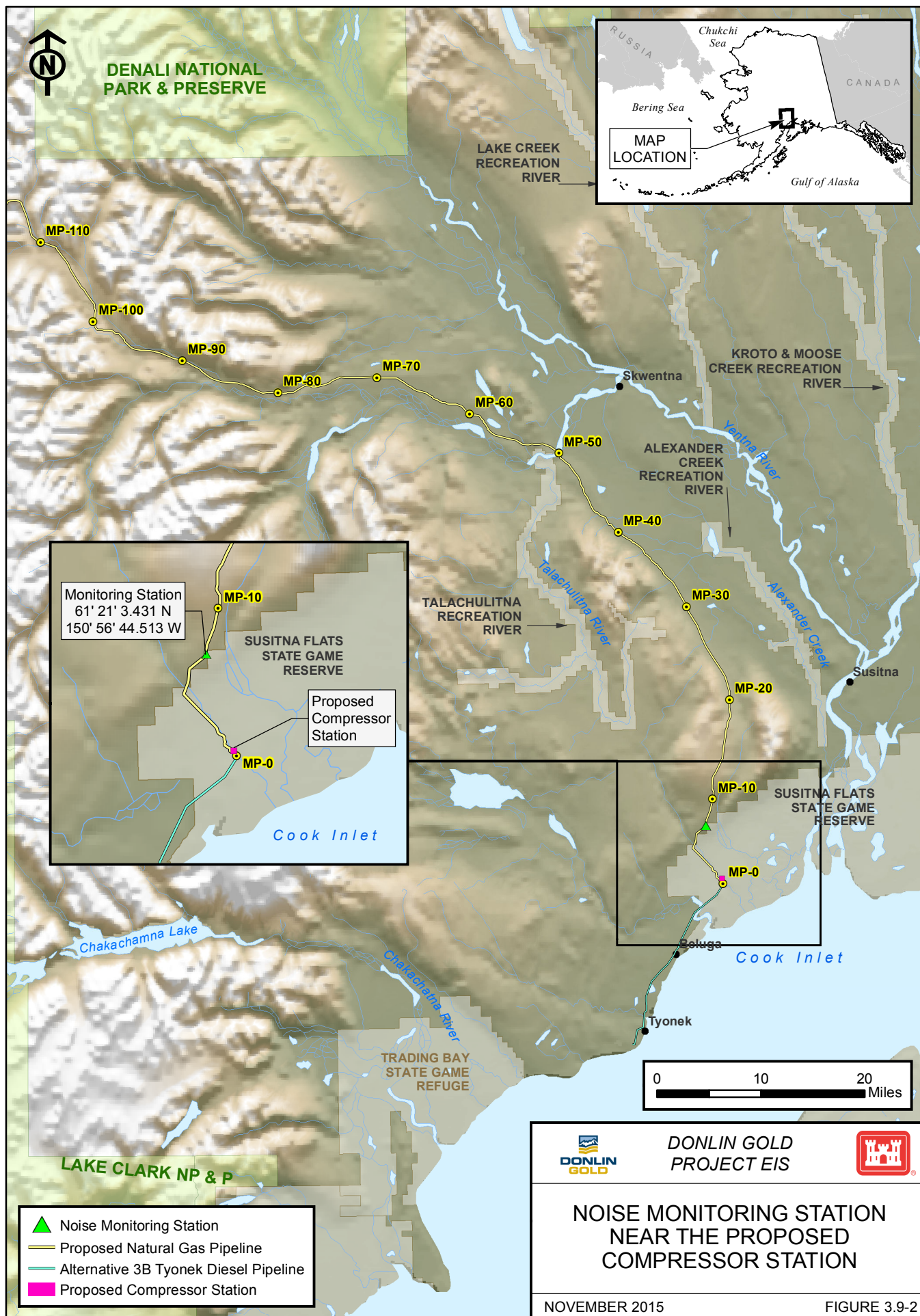
$L_{EQ}(15)$ = Equivalent sound level for 15 hour period, expressed as dBA

Max $L_{EQ}(15)$ = the maximum $L_{EQ}(15)$ for all data collected

Sources: EPA 1978; ARCADIS 2012c; NPC 2013; Endpcnoise.com 2014.

3.9.3.4 CLIMATE CHANGE

Climate change is affecting resources in the EIS Analysis area and trends associated with climate change are projected to continue into the future. Section 3.26.3 discusses climate change trends and impacts to key resources in the physical environment including atmosphere, water resources, and permafrost. Climate change is not anticipated to impact noise and vibration levels.



3.9.4 ENVIRONMENTAL CONSEQUENCES

This section of this EIS covers primarily direct effects on human receptors during the construction, operations, closure, and reclamation of the project. Potential noise and vibration impacts resulting from the Donlin Gold Project on resources, such as wildlife or threatened and endangered species, are considered to be indirect impacts, and are described further in Section 3.12, Wildlife, and Section 3.14, Threatened and Endangered Species. The exception, however, is that indirect noise and vibration impacts are discussed as being associated with the expansion of the Bethel and Dutch Harbor Ports, which are operated by third parties.

3.9.4.1 NOISE AND VIBRATION IMPACTS ANALYSIS METHODOLOGY

Criteria for determining the noise and vibration impacts on a sensitive receptor is based on magnitude or intensity (measured as noise or vibration level), duration, extent, and context, as shown in Table 3.9-10. The quantitative and qualitative descriptions in this table use EPA and FTA noise concepts and guidelines described in Sections 3.9.1.1 and 3.9.2.2 to assess the degree of noise and vibration impacts at the nearest noise or vibration sensitive receptor⁸ for each phase and for each component of the project (EPA 1978; FTA 2006).

Table 3.9-10: Noise and Vibration Impact Assessment Criteria for Rural and Urban Residential Receptors

Impact Category	Effects Summary		
Noise			
Magnitude or Intensity (Level)	<p>Low: Noise level may be comparable to natural sound. Increase in ambient noise level is projected to be less than or equal to 10 dBA for rural (3 dBA for urban) environments, or the overall project-related average noise level is less than 50 dBA _{L_{DN}} at the exterior of the nearest noise-sensitive receptor.</p> <p>Example: Very quiet room fan at low speed at a 3-foot distance (35 dBA), refrigerator (49 dBA) within a 3-foot distance</p>	<p>Medium: Increase in noise level is readily detectable at the nearest sensitive receptor.</p> <p>Increase in ambient noise level is projected to be between 10 dBA and 15 dBA for rural (between 3 dBA and 6 dBA for urban) environments, or the overall project-related average noise level is between 50 dBA and 55 dBA _{L_{DN}} at the exterior of the nearest noise-sensitive receptors.</p> <p>Example: bathroom exhaust fan (54-55 dBA) within a 3-foot distance</p>	<p>High: Noise level dominates the soundscape at the nearest sensitive receptor.</p> <p>Increase in ambient noise level is projected to be 15 dBA or more for rural (6 dBA for urban) environments, or overall project-related average noise level exceeds 55 dBA _{L_{DN}} at the exterior of the nearest noise-sensitive receptor.</p> <p>Example: clothes dryer (56-58 dBA) within a 3-foot distance, hand circular power saw at a 3-foot distance (95 dBA)</p>
Duration	<p>Temporary: Impact is short-term or lasts only through project construction or closure and reclamation.</p>	<p>Long-term: Impact would last from several years up to the life of the project.</p>	<p>Permanent: Impact would last beyond the life of the project, or causes enduring annoyance, risk of hearing impairment to a sensitive receptor, or irreversible adverse impact on existing soundscape; or compromises verbal communication.</p>

⁸ Sensitive receptors are those populations that are more susceptible to the effects of noise and vibration than the population at large and those located in close proximity to localized sources of noise and vibration.

Table 3.9-10: Noise and Vibration Impact Assessment Criteria for Rural and Urban Residential Receptors

Impact Category	Effects Summary		
Geographic Extent	Local: Impact is limited geographically; discrete portions of the proposed Project Area affected.	Regional: Impact extends beyond a local area, potentially affecting resources or populations throughout the EIS Analysis Area.	Extended: Impact affects resources or populations beyond the EIS Analysis Area.
Context	Common: Impact affects usual or ordinary resources that are not depleted or protected by legislation.	Important: Impact affects resources within the region that are depleted or protected by legislation.	Unique: Impact affects unique resources or resources protected by legislation.
Vibration			
Magnitude or Intensity (Level)	Low: Vibration level is barely perceptible. Aggregate vibration level is projected to be between 80 VdB and 65 VdB, the limit of human perception. Example: jackhammer (79 VdB at 25 feet)	Medium: Vibration level can be distinctly perceptible; may be annoying to a sensitive receptor. Aggregate vibration level is projected to be between 80 VdB and 90 VdB. Example: large bulldozer (87 VdB at 25 feet)	High: Vibration level may cause damage risk in extremely fragile buildings, ruins and monuments. Aggregate vibration level is projected to be 0.12 in/sec peak particle velocity (PPV) or greater at vibration sensitive receptors (with respect to human perception, Lv > 90 VdB). Example: pile driver (93-105 VdB at 25 feet)
Duration	Temporary: Impact is temporary or lasts only through project construction or closure and reclamation.	Long-term: Impact would last from several years up to the life of the plan.	Permanent: Impact could cause major damage to structures at the nearest sensitive receptor.
Geographic Extent	Local: Impact affects resources or populations within or adjacent to project components.	Regional: Impact extends beyond a local area, potentially affecting resources or populations throughout the proposed Project Area.	Extended: Impact affects resources or populations beyond proposed Project Area.
Context	Common: Impact affects usual or ordinary resources that are not depleted or protected by legislation.	Important: Impact affects resources within the region that are depleted or protected by legislation.	Unique: Impact affects unique resources or resources protected by legislation.

Sources: EPA 1978; FTA 2006; Endpcnoise.com 2014; NPC 2013.

Predicted increases in ambient noise and vibration levels due to the project are calculated at a given sensitive receptor using reference sound and vibration levels of typical equipment and background noise and vibration data.

The noise levels are calculated using the noise analysis tool developed by the USDOT, Federal Highway Administration Roadway Construction Noise Model (FHWA RCNM)⁹ version 1.1, using the following equations (Caltrans 2009):

⁹ The RCNM is the FHWA's national model for the prediction of construction noise (FHWA RCNM 2006b).

- To add equal sound pressure levels:

$$\text{SPL}_{\text{Total}} = \text{SPL}_1 + 10\log_{10}(N)$$

Where: $\text{SPL}_{\text{Total}}$ = total sound pressure level produced

SPL_1 = SPL of one source

N = number of identical sources to be added (must be more than 0)

- To add unequal sound pressure levels:

$$\text{SPL}_{\text{Total}} = 10\log_{10}[10^{\text{SPL}_1/10} + 10^{\text{SPL}_2/10} + \dots 10^{\text{SPL}_n/10}]$$

Where: $\text{SPL}_{\text{Total}}$ = total sound pressure level produced

SPL_1 , SPL_2 , and ... SPL_n represent the first, second, and n^{th} SPL, respectively

- To calculate a noise level with respect to a known noise level at a known or referenced distance from a point source:

$$\text{dBA}_2 = \text{dBA}_1 + 20\log_{10}(D_1/D_2)$$

Where: dBA_1 = noise level at a distance D_1 from the point source

dBA_2 = noise level at distance D_2 from the same point source

- To calculate a noise level from a point source moving along a line¹⁰:

$$\text{dBA}_2 = \text{dBA}_1 + 10\log_{10}(D_1/D_2)$$

Where: dBA_1 = noise level at a distance D_1 from the point source

dBA_2 = noise level at distance D_2 from the same point source

The vibration level (Lv) of equipment in vibration decibels (VdB) at any distance (D) is estimated using the following equation (FTA 2006):

$$\text{Lv}(D) = \text{Lv}(D_{\text{ref}}) - 30\log(D/D_{\text{ref}}) \text{ VdB}$$

Where: $\text{Lv}(D)$ = vibration level at any distance, D, from a vibration source; and

$\text{Lv}(D_{\text{ref}})$ = measured vibration level at a reference distance, D_{ref} , from the same vibration source

The following assumptions and approaches were made in the noise and vibration impact analyses:

- Noise level increases and overall project-related average noise levels are calculated taking into account noise generated from construction, operations, and reclamation activities, as well as the existing ambient noise levels at the locations of the noise source and sensitive receptor. The calculations assume a conservative shielding factor of 3 dBA¹¹ and typical acoustical usage factors¹² (FHWA RCNM 2006b) for each type of equipment.

¹⁰ Sound emanating from a point source moving along a line, or a line source, e.g., a continuous stream of roadway traffic and is independent of frequency, is called "cylindrical divergence" (FHWA TNM 2011b).

¹¹ Per the FHWA RCNM User's Guide (Appendix A: Best Practices for Calculating Estimated Shielding for Use in the RCNM), January 2006, an assumed shielding factor of 3 dBA corresponds to a noise barrier or other obstruction (like a dirt mound) that barely breaks the line-of sight between the noise source and the receptor (FHWA RCNM 2006b).

- For construction and closure and reclamation activities, where a detailed schedule of equipment operations at specific project locations is not available, noise level estimates are calculated in accordance with the general noise assessment guidance provided in the Transit Noise and Vibration Impact Assessment report by the FTA, Office of Planning and Environment (2006). The report states, “For projects in an early assessment stage when the equipment roster and schedule are undefined, only a rough estimate of construction noise levels is practical.” This method assumes only the two noisiest pieces of equipment expected to be used in each phase to predict noise generated and represents a set of equipment doing construction work from one crew and assumes that only one crew would be operating at any one time (FTA 2006). This approach does not use the 3 dBA shielding factor. This assumption applies to:
 - civil construction at the mine site component;
 - construction of mine access road, Angyaruaq (Jungjuk) Port, airstrip, and Bethel cargo terminal and fuel storage at the transportation facilities component; and
 - civil construction, pipeline construction, and post-construction reclamation at the pipeline component.
- The resulting noise and vibration levels on the affected noise- or vibration-sensitive receptor for each project component are compared to the noise and vibration criteria in Table 3.9-10 to assess their impact levels for intensity.

Table 3.9-11, Table 3.9-12, and Table 3.9-13 list all noise sensitive receptors within 15 miles¹³ of major noise sources associated with each component of the project. These noise sources are shown in Figure 3.9-3.

Table 3.9-11: Noise- and Vibration-Sensitive Receptors within 15 Miles of Mine Site Noise and Vibration Sources, by Subcomponent

Sensitive Receptor	Subcomponent	
	Mine Site (miles) ¹	Permanent Camp Site (miles) ¹
Communities		
Crooked Creek	9.15	11.34
Georgetown	12.73	>15

Notes:

1 Distances were determined using GIS spatial analysis tool, ESRI ArcGIS NEAR, which calculates the distance from each point in one feature class to the nearest point or line feature in another feature class.

12 Acoustical usage factor is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation.

13 A 15-mile radius is used as a reference distance for noise impact in this EIS because it is considered to be a distance beyond which the noise impact is expected to be negligible or no effect. It is conservative as the nearest community to the Project Area is about 10 miles away.

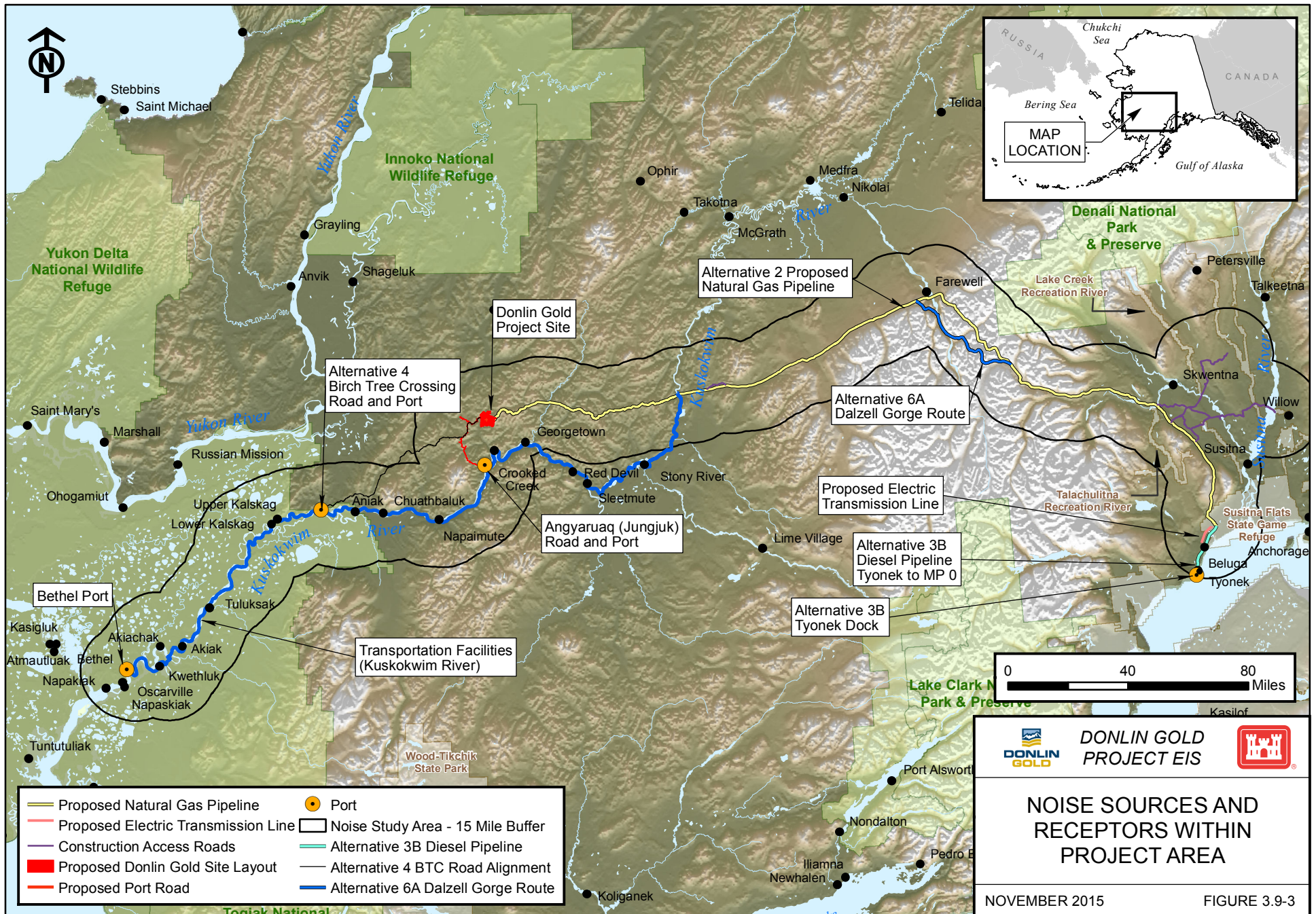


Table 3.9-12: Noise- and Vibration-Sensitive Receptors within 15 Miles of Transportation Facilities Noise and Vibration Sources, by Subcomponent

Sensitive Receptor	Subcomponent						
	River Traffic (mi) ¹	Airstrip (mi) ¹	Mine Access Road (mi) ¹	Angyaruaq (Jungjuk) Material Sites (mi) ¹	Angyaruaq (Jungjuk) Port Site (mi) ¹	Bethel Port Site (mi) ¹	Dutch Harbor Port Site (mi) ¹
Communities							
Akiachak	0.17	>15	>15	>15	>15	13.64	>15
Akiak	0.00	>15	>15	>15	>15	>15	>15
Aniak	0.00	>15	>15	>15	>15	>15	>15
Bethel	0.18	>15	>15	>15	>15	0.00	>15
Chuathbaluk	0.13	>15	>15	>15	>15	>15	>15
Crooked Creek	5.90	14.83	5.93	6.64	5.94	>15	>15
Georgetown	>15	>15	>15	>15	>15	>15	>15
Kwethluk	0.37	>15	>15	>15	>15	>15	>15
Lower Kalskag	0.00	>15	>15	>15	>15	10.91	>15
Napaimute	0.00	>15	>15	>15	>15	>15	>15
Napakiak	8.75	>15	>15	>15	>15	9.38	>15
Napaskiak	4.52	>15	>15	>15	>15	5.84	>15
Oscarville	3.59	>15	>15	>15	>15	4.64	>15
Tuluksak	0.18	>15	>15	>15	>15	>15	>15
Upper Kalskag	0.09	>15	>15	>15	>15	>15	>15

Table 3.9-12: Noise- and Vibration-Sensitive Receptors within 15 Miles of Transportation Facilities Noise and Vibration Sources, by Subcomponent

Sensitive Receptor	Subcomponent						
	River Traffic (mi) ¹	Airstrip (mi) ¹	Mine Access Road (mi) ¹	Angyaruaq (Jungjuk) Material Sites (mi) ¹	Angyaruaq (Jungjuk) Port Site (mi) ¹	Bethel Port Site (mi) ¹	Dutch Harbor Port Site (mi) ¹
City of Unalaska	>15	>15	>15	>15	>15	>15	0.00
Parks							
Yukon Delta National Wildlife Refuge	0.0	>15	>15	>15	>15	0.0	>15

Notes:

1 Distances were determined using GIS spatial analysis tool, ESRI ArcGIS NEAR, which calculates the distance from each point in one feature class to the nearest point or line feature in another feature class.
mi = miles

Table 3.9-13: Noise- and Vibration-Sensitive Receptors within 15 Miles of Natural Gas Pipeline Noise and Vibration Sources, by Subcomponent

Sensitive Receptor	Subcomponent												
	NGP (mi) ¹	Metering Stations ² and Block Valves (mi) ¹	Distr. Station (mi) ¹	Comp. Station (mi) ¹	L/R (mi) ¹	PSY (mi) ¹	Airstrip (mi) ¹	Temp. Camp (mi) ¹	Mat'l Sites (mi) ¹	Temp HDD Work Space (mi) ¹	Work Pads (mi) ¹	Water Extn. Sites (mi) ¹	Pipeline Access Roads (mi) ¹
Communities													
Beluga	12.37	12.38	>15	12.43	>15	>15	>15	>15	9.08	>15	>15	12.71	13.86
Crooked Creek	10.09	10.09	10.07	>15	>15	14.12	>15	>15	>15	>15	>15	>15	10.00

Table 3.9-13: Noise- and Vibration-Sensitive Receptors within 15 Miles of Natural Gas Pipeline Noise and Vibration Sources, by Subcomponent

Sensitive Receptor	Subcomponent												
	NGP (mi) ¹	Metering Stations ² and Block Valves (mi) ¹	Distr. Station (mi) ¹	Comp. Station (mi) ¹	L/R (mi) ¹	PSY (mi) ¹	Airstrip (mi) ¹	Temp. Camp (mi) ¹	Mat'l Sites (mi) ¹	Temp HDD Work Space (mi) ¹	Work Pads (mi) ¹	Water Extn. Sites (mi) ¹	Pipeline Access Roads (mi) ¹
Farewell	1.92	7.90	>15	>15	7.94	2.14	3.25	3.45	2.26	>15	7.91	2.14	1.90
Georgetown	10.12	10.28	13.80	>15	>15	10.18	>15	>15	11.83	11.90	>15	12.12	11.27
Skwentna	8.71	10.44	>15	>15	>15	8.76	11.14	10.08	8.61	8.69	>15	8.76	6.29
Susitna	11.62	14.95	>15	>15	>15	11.83	>15	>15	11.61	>15	>15	10.86	10.86
Willow	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	4.55
Parks													
Alexander Creek Rec River	4.02	6.34	>15	>15	>15	4.02	9.02	9.18	4.04	15.08	>15	3.57	0.00
Denali Nat. Park & Preserve	4.37	5.76	>15	>15	>15	4.26	6.38	6.66	4.25	21.34	>15	4.52	4.31
Kroto & Moose Creek Rec River	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	0.00
Lake Creek Rec River	12.76	12.94	>15	>15	>15	12.85	12.63	12.77	12.83	13.82	>15	12.07	0.00
Little Susitna Rec River	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	9.84
Nancy Lake State Rec Area	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	5.28

Table 3.9-13: Noise- and Vibration-Sensitive Receptors within 15 Miles of Natural Gas Pipeline Noise and Vibration Sources, by Subcomponent

Sensitive Receptor	Subcomponent												
	NGP (mi) ¹	Metering Stations ² and Block Valves (mi) ¹	Distr. Station (mi) ¹	Comp. Station (mi) ¹	L/R (mi) ¹	PSY (mi) ¹	Airstrip (mi) ¹	Temp. Camp (mi) ¹	Mat'l Sites (mi) ¹	Temp HDD Work Space (mi) ¹	Work Pads (mi) ¹	Water Extrn. Sites (mi) ¹	Pipeline Access Roads (mi) ¹
Susitna Flats State Game Refuge	0.00	0.00	>15	0.00	>15	0.33	>15	>15	0.00	>15	>15	0.00	0.00
Talachulitna Rec River	0.36	2.10	>15	>15	>15	0.46	1.25	0.30	0.32	0.35	>15	0.39	0.29
Willow Creek State Rec Area	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	0.00
Willow Mtn. Critical Habitat Area	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	>15	12.78

Notes:

1 Distances were determined using GIS spatial analysis tool, ESRI ArcGIS NEAR, which calculates the distance from each point in one feature class to the nearest point or line feature in another feature class.

2 There are two metering stations: one at MP 0 and another one at MP 319. The nearest sensitive receptors to the metering stations at pipeline MP 0 and MP 319 are Beluga and Crooked Creek, respectively.

Abbreviations:

Comp = Compressor
Ck = Creek
Distr. = Distribution

Extrn. = Extraction
HDD = Horizontal Directional Drilling
L/R = Pig Launcher/Receiver

Mat'l = Material
mi = miles
Temp. = Temporary

NGP = Natural Gas Pipeline
PSY = Pipe Storage Yards
Rec = Recreational

> greater than

3.9.4.2 ALTERNATIVE 1 – NO ACTION

Under the No Action Alternative, the proposed project would not be undertaken and the required permits would not be issued. Consequently, there would be no noise or vibration impacts on any sensitive receptors from the implementation of the No Action Alternative.

3.9.4.3 ALTERNATIVE 2 – DONLIN GOLD'S PROPOSED ACTION

3.9.4.3.1 MINE SITE

The following factors used in the noise and vibration impact analyses are common to the construction, operations, and closure and reclamation phases for the mine site component:

- The nearest sensitive receptor is Crooked Creek (9.15 miles away from the mine site), with a corresponding existing ambient noise level of 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA.
- The existing ambient noise level at the mine site is estimated at 35 dBA L_{DN} (adapted from Table 3.9-2 for Wilderness Ambient; also see Table 3.9-7) and L_{EQ} estimated at 29 dBA.
- The context of any impacts at Crooked Creek would be considered common, as there are no unique resources or resources protected by legislation.

Construction

The construction phase of the mine site would take place over a 3- to 4-year period. Construction activities within the mine site would consist of initial pioneering and development of pits to be mined; and the construction of mining facilities, milling facilities, tailings, waste rock, overburden storage facilities, haul roads, and support infrastructure. These activities would require use of heavy equipment such as wheel loaders, dozers, drills, and haul trucks.

Construction noise levels are rarely steady; instead they fluctuate and are intermittent, depending on the number and type of equipment in use at any given time. There would be times when no large equipment is operating and noise would be at or near existing ambient levels. In addition, construction-related sound levels experienced by a sensitive receptor in the vicinity of construction activity would be a function of distance and the presence and extent of vegetation and intervening topography between the noise source and the sensitive receptor.

Table 3.9-14 and Table 3.9-15 list noise levels produced by construction machinery that would be operated at the mine site. These are noise levels measured at 50 feet from the source, in units of the A-weighted decibel scale (dBA). These equipment lists are considered conservative assumptions (i.e., using maximum noise level values, L_{MAX}) to estimate the noise levels at the nearest sensitive receptor, Crooked Creek.

Table 3.9-14: Major Noise Sources and Noise Levels for Construction of Mine Site Pits

Equipment ¹	Total Number of Units ²	Acoustical Usage Factor (%) ³	Maximum Noise Levels per Unit, L _{MAX} at 50 Feet (dBA) ^{4, 5}	Total Noise Levels, L _{MAX} at 50 Feet (dBA) ⁸
Hydraulic Shovel (Electric)	1	20	93	93
Hydraulic Shovel (Diesel)	1	20	93	93
Front-End Loader	2	40	80	83
Haul Truck (400 st)	11	40	84	94
Haul Truck (150 st)	10	40	84	94
Rubber Tired Dozer	6	40	85	93
Water Truck	1	40	84	84
Hydraulic Excavator	4	40	85	91
Drill Rigs	9	20	84	94
Track Dozer	7	40	85	93
Grader	4	40	85	91
Fuel Truck	3	40	84	89
Blasting ⁷	NA	1	94	94
Primary Crusher	1	50	90 ⁶	90
Grinding	1	50	80 ⁶	80
Service Truck	1	40	84	84
Mobile Crane	1	16	85	85
Low Boy Truck	1	40	84	84
Tire Handler	2	20	85	88
Light Plant	20	50	82	95
Light Vehicle	TBD	40	55	TBD

Notes:

- Equipment lists are as provided in Fernandez 2014f. This is an estimate of primary equipment operating at the mine site during construction of pits.
- The total number of equipment units represents an estimated total number of units that would be operated at the mine site during different stages of the construction phase.
- Acoustical usage factor is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation. Acoustical usage factor provided in the table are equivalent default values from FHWA RCNM version 1.1.
- The noise levels listed represent the A-weighted maximum sound level (L_{MAX}) (per equivalent equipment specifications provided in FHWA RCNM version 1.1, except as noted) measured at a distance of 50 feet from the equipment.
- Noise levels are equivalent default values from FHWA RCNM version 1.1.
- Noise levels are as provided in ARCADIS 2013a.
- The construction of the mine site infrastructure could require the use of blasting in select areas of rocky terrain. Additional information regarding explosives and blasting needs would be developed during detailed engineering design (Fernandez 2013d).
- Estimated total noise levels emitted by multiple equipment units of the same type using the equation for adding equal sound pressure levels in Section 3.9.4.1.

Abbreviations:

dBA = A-weighted decibel

L_{MAX} = Maximum L_{EQ} (equivalent sound level)

NA = Not Applicable

st = short ton

TBD = To Be Determined

Sources: Fernandez 2014f; FHWA 2006a.

Table 3.9-15: Major Noise Sources and Noise Levels for Construction of Mine Site Support Facilities

Equipment ¹	Maximum Noise Levels, L _{MAX} at 50 Feet (dBA) ^{3,4}
Civil Construction (mine roads, support facilities, buildings, camps, and infrastructures) ²	
Air-track Drill	85
CAT 14H	85
CAT 365	85
CAT 725 Water Truck	84
CAT D6	85
CAT IT28	85
Compactor 563	80
Compactor 815	80
Compactor 825	80
Crusher 300 tph & Screen	90 ⁵
Dozer D10	85
Dozer D8	85
Dozer D9	85
Excavator 330	85
Excavator 345	85
Excavator 385	85
Grader 16H	85
Impact Pile Driver ⁶	95
Loader 963	80
Loader 980	80
Loader 988H	80
Truck 740	84

Notes:

- Equipment lists are as provided in Fernandez 2014f.
- Equipment list for civil construction provided in this table assumes a conservative scenario (i.e., during the third year of construction period) and includes construction activities for all project facilities, including: Angyaruaq (Jungjuk) Port, Bethel Port, Dutch Harbor Port, mine access road, airstrip, permanent camp, and mine support facilities.
- The noise levels listed represent the A-weighted maximum sound level (L_{MAX}) (per equivalent equipment specifications provided in FHWA RCNM version 1.1, except as noted) measured at a distance of 50 feet from the construction equipment.
- Noise levels are equivalent default values from FHWA RCNM version 1.1.
- Noise levels are as provided in ARCADIS 2013a.
- Operation of impact pile driver applies to construction of the Angyaruaq (Jungjuk) Port, Bethel Port, and Tyonek Port (under Alternative 3B).

Abbreviations:

dBA = A-weighted decibel L_{MAX} = Maximum L_{EQ} (equivalent sound level) TBD = To Be Determined

Sources: Fernandez 2014f; FHWA 2006a.

Ground-borne vibration would also occur in the immediate vicinity of construction activities at the mine site, particularly if rock drilling, pile driving, or blasting is required. Table 3.9-16 lists vibration levels produced by typical construction machinery and activities at 25 feet in units of vibration decibels (VdB) (FTA 2006).

Table 3.9-16: Vibration Source Levels for Mine Site Construction Equipment (VdB)

Equipment	VdB at 25 Feet
Pile Driver (impact type)	104-112
Pile Driver (sonic or vibratory type)	93-105
Clam shovel Drop (slurry wall)	94
Hydromill (slurry wall)	66-75
Vibratory Roller	94
Large Bulldozer	87
Caisson drilling	87
Loaded Trucks	86
Blasting	100 (at 50 feet)
Jackhammer	79
Small Bulldozer	58

Notes:
VdB = Vibration decibel
Source: FTA 2006.

Conservative assumptions were made for noise estimates in the absence of a detailed schedule of equipment operations during the construction phase. For the construction of the mine pits, a construction event is assumed to include simultaneous operation of all equipment listed in Table 3.9-14. For the construction of support infrastructures within the mine site and in accordance with the FTA guidance on general assessment for noise impacts (FTA 2006), noise estimates are calculated based on the two loudest equipment units from the list in Table 3.9-15. The two loudest equipment units from the list have noise levels of 90 dBA and 85 dBA at 50 feet.

The estimated project-related noise level from the mine site during the construction phase would be 44 dBA L_{DN} . The resulting noise levels at Crooked Creek, including the existing ambient noise, would be approximately 46 dBA L_{DN} , an increase of 7 dBA L_{DN} compared to the existing ambient level (see discussion in Section 3.9.1.1 and examples of noise levels in Table 3.9-1, and Table 3.9-2 for explanation of what these noise levels mean.) Maximum noise levels could reach up to 43 dBA L_{MAX} , however impacts would be low intensity, but detectable, and lasting only through the construction phase. The exact noise values would depend on the number and type of noise sources operating at the same time from the same reference distance.

The vibration level (Lv) of equipment listed in Table 3.9-16 at any distance (D) may be estimated using the following equation (FTA 2006):

$$Lv(D) = Lv(25 \text{ ft}) - 30\log(D/25) \text{ VdB}$$

Using the highest vibration level of 112 VdB at 25 feet (for pile driver [impact type]) from Table 3.9-16 as a conservative assumption, the estimated vibration level at the sensitive receptor (Crooked Creek) from construction equipment would be less than 14 VdB, which is well below the FTA threshold for human perception of 65 VdB (from Table 3.9-5) and damage threshold for fragile buildings of 0.12 in/sec PPV (from Table 3.9-6). The intensity of the vibration impact at Crooked Creek would be considered low per Table 3.9-10. Vibration impacts would be temporary, occurring intermittently throughout the construction phase, and localized at the sensitive receptor site.

Operations and Maintenance

Operations at the mine site would involve extracting rock from the ground and delivering ore to the milling facilities and waste rock to the WRF. Routine and preventive maintenance of support facilities and infrastructure (such as mine roads, landfill trenches, and other associated mining facilities) would occur within the mine site area for sound management and safety practices. Noise and vibration impacts would be generated due to operations of industrial-type heavy equipment used in extracting material from the ground, transporting ore, overburden, and waste rock, blasting, and such other activities.

Milling is the process of extracting gold from the ore. Considerable noise levels are emitted during crushing and grinding steps.

Table 3.9-17 shows a list of noise-producing equipment that would be used during the mining and milling processes of the Donlin Gold Project. This list represents an estimate of maximum operating units at one time.

Table 3.9-17: Major Noise Sources and Estimated Maximum Noise Levels for Operations and Maintenance Activities at the Mine Site

Equipment ¹	Number of Units	Acoustical Usage Factor (%) ²	Maximum Noise Levels per Unit, L _{MAX} at 50 Feet (dBA) ^{3, 4}	Total Noise Levels, L _{MAX} at 50 Feet (dBA) ⁶
Hydraulic Shovel (Electric)	6	20	93	101
Hydraulic Shovel (Diesel)	1	20	93	93
Front-End Loader	3	40	80	85
Haul Truck (400 st)	69	40	85	103
Haul Truck (150 st)	10	40	85	95
Rubber Tired Dozer	6	40	85	93
Water Truck	4	40	84	90
Hydraulic Excavator	4	40	85	91

Table 3.9-17: Major Noise Sources and Estimated Maximum Noise Levels for Operations and Maintenance Activities at the Mine Site

Equipment ¹	Number of Units	Acoustical Usage Factor (%) ²	Maximum Noise Levels per Unit, L_{MAX} at 50 Feet (dBA) ^{3, 4}	Total Noise Levels, L_{MAX} at 50 Feet (dBA) ⁶
Drill Rigs	32	20	85	100
Track Dozer	10	40	85	95
Grader	10	40	85	95
Fuel Truck	3	40	84	89
Blasting ⁷	1	1	94	94
Primary Crusher	1	50	90 ⁵	90
Grinding	1	50	80 ⁵	80
Power Generation	1	50	82	82
Service Truck	1	40	84	84
Mobile Crane	1	16	85	85
Low Boy Truck	1	40	84	84
Tire Handler	2	20	85	88
Light Plant	20	50	82	95
Light Vehicle	TBD	40	55	TBD

Notes:

- Equipment lists are as provided in Fernandez 2014f.
- Acoustical usage factor (equivalent default values provided in FHWA RCNM version 1.1) is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation.
- The noise levels listed represent the A-weighted maximum sound level (L_{MAX}) (per equivalent equipment specifications provided in FHWA RCNM version 1.1, except as noted) measured at a distance of 50 feet from the equipment.
- Noise levels are equivalent default values from FHWA RCNM version 1.1.
- Noise levels are as provided in ARCADIS 2013a.
- Estimated total noise levels emitted by multiple equipment units of the same type using the equation for adding equal sound pressure levels in Section 3.9.4.1.
- Blasting would be required prior to excavation of the ore and waste rock. A detailed blasting schedule has not been developed for the project at this time; however, for large open pit mines blasting operations would typically occur once a day or once in two days, as needed (Fernandez 2013d).

Abbreviations:

DbA = A-weighted decibel
 L_{MAX} = Maximum L_{EQ} (equivalent sound level)
 NA = Not Applicable
 st = short ton

Sources: Fernandez 2014f; FHWA 2006a

The estimated project-related noise level from the mine site during this phase would be 45 dBA L_{DN} . The resulting noise levels at the sensitive receptor (Crooked Creek), including the existing ambient noise, would be approximately 46 dBA L_{DN} ; an increase of 7 dBA L_{DN} compared to the existing ambient level. Maximum noise levels could reach 45 dBA L_{MAX} . Impacts would be low intensity, but would last through the life of the project.

Using the highest vibration level of 100 VdB at 50 feet (for blasting) from Table 3.9-16 as a conservative assumption, the estimated vibration level at the sensitive receptor (Crooked Creek) from the operations and maintenance activities at the mine site would be less than 11 VdB, which is well below the FTA threshold for human perception of 65 VdB (from Table 3.9-5) and damage threshold for fragile buildings of 0.12 in/sec PPV (from Table 3.9-6). The intensity of the vibration impact at Crooked Creek would be low, per Table 3.9-10. Vibration impacts would occur intermittently throughout the life of the project, and would be localized at the sensitive receptor site.

Closure and Reclamation

In addition to reclamation activities conducted upon final mine closure, concurrent reclamation would be performed during operations whenever possible in areas that are no longer required for active mining. The reclamation phase of the Donlin Gold Project would entail restoration of the ground surface at the WRF, TSF, freshwater and process ponds, and portions of the pit needed for human access. These earthwork activities would require major grading, contouring, and possible growth media placement using industry-standard heavy equipment; operation of this heavy equipment would in turn cause noise and vibration impacts.

Table 3.9-18 shows a list of heavy equipment that would be required to perform the earthwork. This list is used as a conservative assumption (i.e., using maximum noise level values, L_{MAX}) in estimating the noise levels at the sensitive receptor, Crooked Creek.

The estimated project-related noise level from the mine site during this phase would be 38 dBA L_{DN} . The resulting noise levels at the sensitive receptor (Crooked Creek), including the existing ambient noise, would be approximately 42 dBA L_{DN} , an increase of 3 dBA L_{DN} compared to the existing ambient level. Maximum noise levels could reach up to 38 dBA L_{MAX} , however impacts would be low intensity, but detectable, lasting only through the reclamation phase.

It is assumed that there would be no major ground-borne vibration-causing equipment operated at the mine site during the closure and reclamation phase. Therefore, there would be no vibration impacts at Crooked Creek during this phase.

Summary of Mine Site Impacts

Under Alternative 2, the nearest sensitive receptor for the mine site is Crooked Creek, located 9.15 miles away, with corresponding existing ambient noise level of 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA. Impacts during all phases would be of low intensity (slightly detectable) due to the distance from the mine site to Crooked Creek. The duration of impacts would be temporary and intermittent during the construction, and closure and reclamation phases, but would be more constant and long-term during mine site operations. All noise impacts would be local in extent because effects would occur at the sensitive receptor of Crooked Creek. The context would be considered common, as there are no unique or legislatively-protected resources at Crooked Creek. There would be no vibration impacts under Alternative 2.

Table 3.9-18: Major Noise Sources and Estimated Maximum Noise Levels for Closure and Reclamation of Mine Site

Equipment ¹	Number of Units	Acoustical Usage Factor (%) ²	Maximum Noise Levels, L _{MAX} at 50 Feet (dBA) ^{3, 4}	Total Noise Levels, L _{MAX} at 50 Feet (dBA) ⁵
Front-End Loader	8	40	80	89
Water Truck	2	40	84	87
Hydraulic Excavator	4	40	85	91
Drill Rigs	1	20	85	85
Track Dozer	8	40	85	94
Grader	2	40	85	88
Mobile Crane	5	16	85	92
Low Boy Truck	4	40	84	90
Backhoe	4	40	80	86

Notes:

1 Equipment lists are as provided in Fernandez 2014f.

2 Acoustical usage factor (equivalent default values provided in FHWA RCNM version 1.1) is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation.

3 The noise levels listed represent the A-weighted maximum sound level (L_{MAX}) (per equivalent equipment specifications provided in FHWA RCNM version 1.1) measured at a distance of 50 feet from the equipment.

4 Noise levels are equivalent default values from FHWA RCNM version 1.1.

5 Estimated total noise levels emitted by multiple equipment units of the same type using the equation for adding equal sound pressure levels in Section 3.9.4.1.

Abbreviations:

dBA = A-weighted decibel

L_{MAX} = Maximum L_{EQ} (equivalent sound level)

NA = Not Applicable

Source: Fernandez 2014f; FHWA 2006a.

Table 3.9-19 compiles a summary of noise impacts associated with mine site construction, operations, and closure and reclamation activities under Alternative 2.

Table 3.9-19: Summary of Noise Impacts at Nearest Sensitive Receptor for the Mine Site

Subcomponent/ Activities	Nearest Sensitive Receptor	Receptor Distance (miles)	Project-related Noise at Receptor (dBA L _{DN})	Ambient Noise Increase at Receptor (dBA L _{DN})
Construction	Crooked Creek	9.15	44	7
Operations	Crooked Creek	9.15	45	7
Closure and Reclamation	Crooked Creek	9.15	38	3

Abbreviations:

dBA = A-weighted decibel

L_{DN} = Day-Night Sound Level

3.9.4.3.2 TRANSPORTATION FACILITIES

The transportation facilities associated with the project includes the subcomponents of surface transportation, air transportation, and water transportation which are discussed below.

Table 3.9-12 shows the noise- and vibration-sensitive receptors within 15 miles of each subcomponent of the transportation facilities noise sources.

Surface Transportation

Under Alternative 2, a new mine access road would be constructed from the mine site to the Angyaruaq (Jungjuk) Port site near the mouth of Jungjuk Creek. The following factors used in the noise and vibration impact analysis are common to the construction, operations, and closure and reclamation phases for the mine access road:

- The nearest sensitive receptor to the mine access road is Crooked Creek (5.93 miles away), with a corresponding existing ambient noise level of 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA. The nearest sensitive receptor to any mine access road material site is Crooked Creek (6.64 miles away). The context of any impacts at Crooked Creek would be common, as there are no unique protected resources present there.
- The existing ambient noise level at the mine access road is estimated at 35 dBA L_{DN} (adapted from Table 3.9-2 for Wilderness Ambient; also see Table 3.9-7) and L_{EQ} estimated at 29 dBA.
- Noise-producing activities at the mine access road are assumed to occur at their peak levels, i.e., during the 110-summer-day shipping season.

Construction

The mine access road would be constructed as a 30-mile long, 30-foot wide, 2-lane, all-season gravel road. The mine camp facilities would be located at Mile 2.4. Use of this access road would be limited to mine support traffic; public use would not be allowed. It would also include construction of 6 bridges and installation of 45 culverts. Construction activities associated with the mine access road would occur during the first year of the project construction phase.

The estimated project-related noise level from construction activities of the mine access road would be 42 dBA L_{DN} . The resulting noise levels at the sensitive receptor (Crooked Creek), including the existing ambient noise, would be approximately 44 dBA L_{DN} , an increase of 5 dBA L_{DN} compared to the existing ambient level. Impacts at the sensitive receptor would be low intensity and intermittent, but detectable, and lasting only through the construction phase.

The estimated vibration level at Crooked Creek would be approximately 19 VdB, which would be well below the FTA threshold for human perception of 65 VdB (from Table 3.9-5) and damage threshold for fragile buildings of 0.12 in/sec PPV (from Table 3.9-6). The intensity of the vibration impact on Crooked Creek would be low, as per Table 3.9-10. Vibration impacts would be temporary, occurring intermittently throughout the construction phase, and localized at the sensitive receptor site.

Operations and Maintenance

During mining operations, traffic along the mine access road would be at its peak during the 110-summer-day shipping season. Average cargo or fuel arrival/departure to and from the Angyaruaq (Jungjuk) Port or mine site is estimated to occur every 30 minutes, with an average round trip time of 3.25 hours between the Angyaruaq (Jungjuk) Port and the mine site. Table 3.9-20 shows a list of typical vehicles that would be traveling on the mine access road on a typical summer day.

Table 3.9-20: Major Noise Sources and Estimated Maximum Noise Levels for the Operations Phase of Mine Access Road

Equipment ¹	Period of Use	Route	Maximum Noise Level per Unit, L_{MAX} at 50 Feet (dBA) ^{2, 3}
Tanker Trailers (Fuel Transport)	Summer	Angyaruaq (Jungjuk) Port – Mine Site	84
Container Terminal Trailers (Cargo Transport)	Summer	Angyaruaq (Jungjuk) Port – Mine Site	84
4X4 Pick-up Trucks	Summer	Angyaruaq (Jungjuk) Port – Airport – Camp – Mine	55
	Year-round	Airport – Mine Site	
Bus (Personnel Transport)	Year-round	Airport – Camp – Mine Site	55

Notes:

1 Equipment lists are as provided in Fernandez 2014f.

2 The noise levels listed represent the A-weighted maximum sound level (L_{MAX}) (per equivalent equipment specifications provided in FHWA RCNM version 1.1) measured at a distance of 50 feet from the equipment.

3 Noise levels are equivalent default values from FHWA RCNM version 1.1.

Abbreviations:

dBA = A-weighted decibel

NA = Not Applicable

L_{MAX} = Maximum equivalent sound level (L_{EQ})

TBD = To be determined

Sources: Fernandez 2014f; FHWA 2006a; Caltrans 2009.

Given that the road would be 2 lanes, the conservative assumption for noise impacts would be that the two loudest vehicles would pass any point on the road at the same time. The two loudest equipment units (Table 3.9-20) have noise levels of 84 dBA at 50 feet. The estimated project-related noise level at the sensitive receptor (Crooked Creek) from the operations and maintenance phase activities along mine access road would be 31 dBA L_{DN} . The resulting noise levels at Crooked Creek, including the existing ambient noise, would be approximately 40 dBA L_{DN} , an increase of 1 dBA L_{DN} compared to the existing ambient level. Maximum noise levels could reach up to 34 dBA L_{MAX} , however these temporary duration impacts would create no perceivable change in existing ambient noise levels at Crooked Creek. The exact values would depend on the number and type of vehicles passing by at the same time from the same reference distance.

It is assumed that there would be no major ground-borne vibration-causing equipment operated along the mine access road during the operations phase. Therefore, there would be no vibration impacts at Crooked Creek during this phase.

Closure and Reclamation

The mine access road would be needed for post-mining closure and reclamation activities, and would remain as a long-term asset after the end of mining. Therefore, no noise would be expected related to project closure and reclamation activities associated with the mine access road.

During the construction phase, the mine access road would require 14 borrow pits. All but three of these pits would be reclaimed immediately after construction is completed. Table 3.9-21 below shows a list of heavy equipment used to perform earthwork in general reclamation activities and corresponding equivalent noise levels at 50 feet.

Table 3.9-21: Major Noise Sources and Estimated Maximum Noise Levels for General Reclamation Activities Associated with the Mine Access Road Material Sites

Equipment ¹	Acoustical Usage Factor (%) ²	Maximum Noise Levels, L _{MAX} at 50 Feet (dBA) ^{3, 4}
Front-End Loader	40	80
Water Truck	40	84
Haul Truck	40	84
Caterpillar D10N Dozer	40	85
Caterpillar D9N Dozer	40	85
Caterpillar D8L Dozer	40	85
Rubber-tired Dozer	40	85
Rubber-tired Scraper	40	85
Motor Grader	40	85
Backhoe	40	80
Hydro-seeder	50	85
Brillion cultipacker	50	85
Rangeland seed drill	50	85
Broadcast seeder	50	85

Notes:

- Equipment lists are as provided in SRK 2012f.
- Acoustical usage factor (equivalent default values provided in FHWA RCNM version 1.1) is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation.
- The noise levels listed represent the A-weighted maximum sound level (L_{MAX}) (per equivalent equipment specifications provided in FHWA RCNM version 1.1) measured at a distance of 50 feet from the equipment.
- Noise levels are equivalent default values from FHWA RCNM version 1.1.

Abbreviations:

dBA = A-weighted decibel

L_{MAX} = Maximum equivalent sound level (L_{EQ})

NA = Not Applicable

Sources: SRK 2012f; FHWA 2006a.

The nearest sensitive receptor to any Angyaruaq (Jungjuk) material site would be Crooked Creek (6.64 miles away). Noise impact levels were calculated based on the two loudest equipment units with noise levels of 84 dBA and 85 dBA at 50 feet, as shown in Table 3.9-21. The estimated project-related noise level at Crooked Creek from the nearest Angyaruaq (Jungjuk) material site during this phase would be 37 dBA L_{DN} . The resulting noise levels at Crooked Creek, including the existing ambient noise, would be approximately 41 dBA L_{DN} , an increase of 2 dBA L_{DN} compared to the existing ambient level. Noise impacts would be temporary (intermittent impacts lasting only through the closure and reclamation phase), low intensity, and localized at the sensitive receptor site.

It is assumed that there would be no major ground-borne vibration-causing equipment operated on the mine access road or associated material sites during the closure and reclamation phase. Therefore, there would be no vibration impacts at Crooked Creek during this phase.

Air Transportation

The proposed mine site airstrip would be located about 9 miles west of the mine site (Figure 2.3-13, Chapter 2, Alternatives) with a 3-mile airstrip spur road starting at Mile 5.4 of the mine access road.

The following factors used in the noise and vibration impact analyses are common to the construction, operations, and closure and reclamation phases for the airstrip:

- The nearest sensitive receptor is Crooked Creek (14.83 miles away from the airstrip), with a corresponding existing ambient noise level of 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA.
- The existing ambient noise level at the airstrip is estimated at 35 dBA L_{DN} (adapted from Table 3.9-2 for Wilderness Ambient; also see Table 3.9-7) and L_{EQ} estimated at 29 dBA.
- For the aircraft flights, considering the size of the airstrip, it is assumed that only one aircraft would be taking off or landing at the runway at any one time. The maximum noise limit for an airplane is 88 dBA (measured at a distance of 8,200 feet from the start of takeoff roll), and 110 dBA for a helicopter (measured at a distance of 394 feet above ground during flyover) (14 CFR Part 36, Appendix G and Appendix H). This assumption does not apply to the closure and reclamation phase.
- Because the flight routes and vertical aircraft distances are unknown at this time, resulting noise levels during a fly-over at the sensitive receptor of Crooked Creek could not be estimated. However, any noise generated from aircraft fly-overs would be temporary and localized.
- The context of any impacts at Crooked Creek would be considered common, as there are no unique resources or resources protected by legislation.
- It is anticipated that there would be no major ground-borne vibration-causing equipment operated during the construction of the airstrip. Therefore, there would be no vibration impacts at Crooked Creek associated with construction, operations, or closure and reclamation of the airstrip.

Construction

Construction of the airstrip would consist of ground preparation and development of a 5,000-foot by 150-foot gravel runway, as well as installation of three fuel storage tanks and two 200-kW power generators. Major noise sources would come from the use of heavy equipment during the construction phase, as well as from passenger and cargo aircraft taking off and landing. During construction, flight frequency is estimated at a maximum of 8 roundtrip flights per day for airplane fixed wing aircraft. One helicopter would also be needed; however, the number of flights per day during the construction phase is not yet determined. Construction activities associated with the airstrip would occur during the first year of the project construction.

Absent a detailed schedule of equipment operations and aircraft flights, conservative assumptions were used in determining construction related noise levels for the airstrip. Noise impact levels from construction activities were calculated using the two loudest equipment units from Table 3.9-15 (a dozer and a grader), both with a noise level of 85 dBA at 50 feet. Using the higher limit of 110 dBA¹⁴ as the maximum aircraft noise level with a usage factor of 10 percent¹⁵, in addition to the noise levels generated from construction activities and the existing ambient noise level at the airstrip, the estimated project-related noise level from the airstrip would be 40 dBA L_{DN}. The resulting noise levels at the sensitive receptor (Crooked Creek), including the existing ambient noise, would be approximately 43 dBA L_{DN}, an increase of 4 dBA L_{DN} compared to the existing ambient level. Maximum noise levels could reach up to 43 dBA L_{MAX}, however impacts would be considered low intensity (intermittent, but detectable) and temporary, lasting only through the construction phase.

Operations and Maintenance

During airstrip operations, major noise sources would consist of aircraft and the two generators. Flight frequency is estimated at a maximum of four roundtrip flights per day for fixed wing aircraft. Helicopter flights would also be expected; however, the number of flights per day during the operations phase is not yet determined at this time.

Using the higher limit of 110 dBA¹⁴ as maximum aircraft noise level with usage factor of 10 percent¹⁵, in addition to the noise levels produced by the two generators and the existing ambient noise level at the airstrip, the projected noise level from the airstrip would be 40 dBA L_{DN}. The resulting noise levels localized at the sensitive receptor (Crooked Creek), including the existing ambient noise, would be approximately 42 dBA L_{DN}, an increase of 3 dBA L_{DN} compared to the existing ambient level. Maximum noise could reach up to 43 dBA L_{MAX}, however, impacts would be considered low intensity (intermittent, but detectable) and long-term, lasting the life of the project, but would be intermittent due to the nature of the noise source.

Closure and Reclamation

The airstrip would be utilized for post-mining closure and reclamation activities, and would also remain operational as a long-term asset after the end of mining. As activities at the airstrip

14 Noise level of 110 dBA at reference distance of 394 feet above ground would still be 110 dBA when extrapolated at 50 feet lateral distance from the reference point.

15 Usage factor of 10 percent is a conservative assumption given that the aircraft noise is very brief and transient at any given point above ground.

would continue, potential noise impacts at Crooked Creek would be similar to those discussed under the operations phase above. However, it is assumed that once mine closure and reclamation has been completed, the number of daily flights using the airstrip would decrease.

Water Transportation

Angyaruaq (Jungjuk) Port Site

The proposed Angyaruaq (Jungjuk) Port site would serve as a main terminal for river barges from the Bethel Port and a transfer point for cargo going to the mine site. The following factors used in the noise and vibration impact analysis are common to the construction, operations, and closure and reclamation phases for the Angyaruaq (Jungjuk) Port site:

- The nearest sensitive receptor is Crooked Creek (5.94 miles away from the Angyaruaq [Jungjuk] Port site), with a corresponding existing ambient noise level of 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA.
- The existing ambient noise level at the Angyaruaq (Jungjuk) Port site is estimated at 47 dBA L_{DN} (see Table 3.9-8) based on a baseline noise study conducted in 2005 (Mullins 2005); L_{EQ} estimated at 41 dBA.
- Noise-producing activities at the Angyaruaq (Jungjuk) Port site are assumed to occur at their peak levels, i.e., during the 110-summer-day shipping season.
- The context of any impacts at Crooked Creek would be considered common, as there are no unique resources or resources protected by legislation.

Construction

Construction activities associated with the proposed Angyaruaq (Jungjuk) Port site would consist of ground preparation and development of a 21-acre port. Construction activities for the port site would occur during the first year of the project construction phase.

Noise and vibration impacts analyses methodology for the construction of the proposed Angyaruaq (Jungjuk) Port site would be the same as discussed for construction of support infrastructure within the mine site. Noise estimates are calculated based on the equipment list in Table 3.9-15. In addition, construction of the Angyaruaq (Jungjuk) Port would also require pile driving. A pile driver would emit 95 dBA L_{MAX} at 50 feet (FHWA 2006a). Therefore, the two loudest noise levels of 95 dBA and 85 dBA at 50 feet are considered in estimating the noise impact for the Angyaruaq (Jungjuk) Port site construction. The estimated project-related noise level from the port during the construction phase would be 42 dBA L_{DN} . The resulting noise levels at the sensitive receptor (Crooked Creek), including the existing ambient noise, would be approximately 47 dBA L_{DN} , an increase of 8 dBA L_{DN} compared to the existing ambient level. This noise level would create detectable, low intensity, temporary impacts at the sensitive receptor.

The estimated vibration level at Crooked Creek would be approximately 19 VdB, which would be well below the FTA threshold for human perception of 65 VdB (from Table 3.9-5), and the damage threshold for fragile buildings of 0.12 in/sec PPV (from Table 3.9-6). The magnitude of the vibration impact on Crooked Creek would be considered low per Table 3.9-10, and would be intermittent throughout the project construction phase only.

Operations and Maintenance

The 21-acre port would include two river barge berths, a ramp, cargo storage yards, fuel storage tank, office facilities, a truck shop, fuel pump station, water supply, septic system, and other associated support utilities and infrastructure. Electricity for the port would be provided by two 600-kilowatt diesel generators. Full operations at the Angyaruaq (Jungjuk) Port would occur during the 110-day barging season in summer. Operations and maintenance activities during winter months would be limited to facilities maintenance and cargo delivery from the Angyaruaq (Jungjuk) Port to the mine site.

Table 3.9-22 shows a list of noise-producing equipment that would be used during the port operations. This list represents an estimate of maximum operating units at one time. Conservative assumptions were made for noise estimates in the absence of a detailed schedule of equipment utilized during the operations phase; i.e., a noise event is assumed to include simultaneous operation of all equipment units listed in Table 3.9-22.

Noise and vibration impacts analyses methodology for the operations of the proposed Angyaruaq (Jungjuk) Port site would be the same as discussed for the mine site operations using the same conservative assumptions, except that noise levels are calculated based on the equipment list in Table 3.9-22. The estimated project-related noise level from the Angyaruaq (Jungjuk) Port site during this phase would be 45 dBA L_{DN} . The resulting noise levels at the sensitive receptor (Crooked Creek), including the existing ambient noise, would be approximately 46 dBA L_{DN} , an increase of 7 dBA L_{DN} compared to the existing ambient level. This noise level would be low in intensity and localized at the sensitive receptor, but would last through the duration of the project. It is anticipated that there would be no major ground-borne vibration-causing equipment that would be utilized during the operations phase at the Angyaruaq (Jungjuk) Port site; therefore, there would be no vibration impacts at Crooked Creek associated with this phase.

Closure and Reclamation

The Angyaruaq (Jungjuk) Port would be utilized for post-mining reclamation and closure activities, and would remain as a long-term asset after the end of mining. As activities at the port would continue, potential noise impacts at the sensitive receptor of Crooked Creek would be similar to those discussed under the operations phase above. However, it is assumed that once mine closure and reclamation has been completed, the amount of activity at the port site would decrease.

Bethel Port Site

The following factors used in the noise and vibration impact analyses are common to the construction, operations, and closure phases for the Bethel Port site subcomponent:

- The cargo terminal and fuel storage facilities would be placed at the existing Calista/Lynden Port Facility, located 1.7 miles southwest of the main populated area of Bethel.
- The existing ambient noise level at the Bethel Port site is estimated at 59 dBA L_{DN} (adapted from Table 3.9-2 for Old Urban Residential) and L_{EQ} estimated at 53 dBA.

Table 3.9-22: Major Noise Sources and Estimated Maximum Noise Levels for the Operations Phase of Angyaruaq (Jungjuk) Port Site

Equipment ¹	Maximum Number of Units ²	Acoustical Usage Factor (%) ³	Maximum Noise Levels per Unit, L _{MAX} at 50 Feet (dBA) ^{4, 5}	Total Noise Levels, L _{MAX} at 50 Feet (dBA) ⁶
Mobile Harbor Crane (Rigged for ship loading/unloading)	2	16	85	88
Wheel Loader, CAT 966 or equivalent (for cleanup/snow removal)	1	40	80	80
Forklift, 5 Ton All-terrain	1	20	85	85
Forklift, 30 Ton (for container handling)	4	20	85	91
4X4 Pickup trucks	6	40	55	63
Container Trailers (Gravel Road Trailers)	20	40	84	97
Semi-trailer Tractor (for container and fuel handling)	14	40	84	95
Terminal Tractors (Kalmar)	4	40	84	90
Highboy Trailer	1	40	84	84
Fuel transfer truck (2,000 gallon capacity with onboard pump and hoses)	1	40	84	84
600-KW Diesel Generators (for power generation)	2	50	82	85

Notes:

- Equipment lists are as provided in Donlin Gold 2014. This is an estimate of primary equipment operating at the Angyaruaq (Jungjuk) Port site during operations phase.
- The total number of equipment units represents an estimated total number of units that would be operated at the Angyaruaq (Jungjuk) Port site during different events of the operations phase.
- Acoustical usage factor (equivalent default values provided in FHWA RCNM version 1.1) is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation.
- The noise levels listed represent the A-weighted maximum sound level (L_{MAX}) (per equivalent equipment specifications provided in FHWA RCNM version 1.1) measured at a distance of 50 feet from the equipment.
- Noise levels are equivalent default values from FHWA RCNM version 1.1.
- Estimated total noise levels emitted by multiple equipment units of the same type using the equation for adding equal sound pressure levels in Section 3.9.4.1.

Abbreviations:

dBA = A-weighted decibel

L_{MAX} = Maximum equivalent sound level (L_{EQ})

NA = Not Applicable

Sources: Fernandez 2014f; FHWA 2006a.

- To demonstrate noise and vibration impacts at certain distances, noise and vibration impacts analyses at each phase are presented in terms of noise and vibration levels at various distances, starting at a distance of 500 feet.
- Noise-producing activities at the Bethel Port site are assumed to occur at their peak levels, i.e., during the 110-summer-day shipping season.

- This project location is within the Yukon Delta National Wildlife Refuge, a legislatively-protected resource area. However, as the Bethel Port is already a developed area, no new receptors would be impacted. Therefore, the context of any impacts at the nearest sensitive receptor would be common.
- All activities at the Bethel Port site would be handled by third parties; therefore, impacts resulting from the project would be considered indirect.

Construction

Construction activities would consist of building of the proposed cargo terminal and fuel storage at the Bethel Port site. This would entail ground preparation and construction of a 16-acre cargo terminal, a 3.5-acre area for buildings, access roads and other support facilities, and additional fuel storage with a total capacity of 4 Mgal within the existing tank farm. Cargo deliveries per shipping season to the Bethel Port site would occur 16 times during the construction phase of the mine site (see Chapter 2, Table 2.3-7). Construction activities for the Bethel Port site would occur during the first year of the proposed project construction phase.

Noise estimates are calculated based on the equipment list in Table 3.9-15. In addition, construction of the Bethel Port would also require pile driving. A pile driver would emit 95 dBA L_{MAX} at 50 feet (FHWA 2006a). Therefore, the two loudest noise levels of 95 dBA and 85 dBA at 50 feet are considered in estimating the noise impact for the Bethel Port construction. Vibration levels at the sensitive receptor are estimated using the highest vibration level of 112 VdB at 25 feet (for pile driver, impact type) from Table 3.9-16.

For analysis purposes, an existing ambient noise level of 59 dBA L_{DN} for Old Urban Residential (see Table 3.9-2) has been used to correspond to the ambient noise level in the City of Bethel, which is the largest community in western Alaska. Table 3.9-23 lists distances from the Bethel Port site and corresponding predicted noise and vibration impact levels. The intensity of noise effects resulting from construction activities would start to attenuate from high intensity at a distance of 3,000 feet to low intensity at a distance of 1.25 miles or more. Vibration impacts would be low (barely perceptible, 8 VdB over the human perception threshold of 65 VdB) even at a distance of 500 feet during construction.

Operations and Maintenance

The cargo terminal and fuel storage site at the Bethel Port site would be operated 24 hours a day, 7 days per week during the 110-day shipping season. For the remainder of the year, activities at the cargo terminal would be limited to care-and-maintenance mode. Cargo deliveries per shipping season to the Bethel Port site would occur 12 times during the operations phase of the mine site (see Chapter 2).

Noise generated during operation of the cargo terminal and fuel storage would originate mainly from heavy equipment used in moving cargo to a designated location in either the yard or the warehouse. Table 3.9-24 shows a list of equipment that would be utilized during the operations phase of the Bethel Port site, and the corresponding noise levels produced. This list represents an estimate of maximum operating units at one time.

Table 3.9-23: Summary of Construction Noise and Vibration Levels at Various Distances:
Bethel Port Site^{1,2}

Project-Related Noise Levels at Different Locations ³							
Receptor Distance	500 Feet	1,000 Feet	1,500 Feet	2,000 Feet	3,000 Feet	1.25 Miles	1.7 Miles
L _{DN} (dBA)	77	71	68	65	62	55	51
Future Ambient Level at Receptor ⁴ (Project-related + Existing Ambient Level [59 dBA])							
L _{DN} (dBA)	82	75	72	70	67	62	61
Ambient Noise Level Increase at Receptor ⁴ (Future Ambient Level – Existing Ambient Level [59 dBA])							
Ambient Noise level increase (dBA L _{DN})	23	16	13	11	8	3	2
Vibration Levels at Sensitive Receptor Location (VdB)							
Vibration Level (VdB)	73	64	59	55	50	4	0

Notes:

- Noise and vibration levels were calculated based on the generic construction equipment list in Table 3.9-15 and an additional pile driver, and using the same calculation methodologies for the mine site construction noise and vibration levels.
- Impact levels were assessed in accordance with the EPA and FTA guidelines on noise and vibration thresholds discussed in Table 3.9-10 and Section 3.9.2.2.
- Project-related noise levels at receptor means the estimated noise levels at receptor location resulting from logarithmic combination of noise generated by construction equipment and existing point source ambient, but not including the receptor's existing ambient level.
- Ambient noise level increase at receptor means the arithmetic difference between future ambient noise level at the receptor location (estimated by logarithmic combination of project-related and existing receptor ambient noise levels) and existing ambient level.

Abbreviations:

dBA = A-weighted decibel L_{MAX} = Maximum equivalent sound level (L_{EQ}) L_{DN} = Day-Night Sound Level

Sources: Caltrans 2009; FHWA 2006a; FTA 2006.

Table 3.9-24: Major Noise Sources and Estimated Maximum Noise Levels for the
Operations Phase of the Bethel Port Site

Equipment ¹	Maximum Number of Units	Acoustical Usage Factor (%) ²	Maximum Noise Levels per Unit, L _{MAX} at 50 Feet (dBA) ^{3, 4}	Total Noise Levels, L _{MAX} at 50 Feet (dBA) ⁵
Mobile Harbor Crane (Rigged for ship loading/unloading)	2	16	85	88
Wheel Loader, CAT 966 or equivalent (for cleanup/snow removal)	1	40	80	80
Forklift, 5 Ton All-terrain	1	20	85	85
Forklift, 30 Ton (for container handling)	6	20	85	93
4X4 Pickup trucks	2	40	55	58
Container Trailers	12	40	84	95

Table 3.9-24: Major Noise Sources and Estimated Maximum Noise Levels for the Operations Phase of the Bethel Port Site

Equipment ¹	Maximum Number of Units	Acoustical Usage Factor (%) ²	Maximum Noise Levels per Unit, L _{MAX} at 50 Feet (dBA) ^{3, 4}	Total Noise Levels, L _{MAX} at 50 Feet (dBA) ⁵
Container Tractor	6	40	84	92
Vehicle Maintenance Truck	1	40	84	84
Highboy Trailer	1	40	84	84

Notes:

- Equipment lists are as provided in Fernandez 2014f.
- Acoustical usage factor (equivalent default values provided in FHWA RCNM version 1.1) is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation.
- The noise levels listed represent the A-weighted maximum sound level (L_{MAX}) (per equivalent equipment specifications provided in FHWA RCNM version 1.1) measured at a distance of 50 feet from the equipment.
- Noise levels are equivalent default values from FHWA RCNM version 1.1.
- Estimated total noise levels emitted by multiple equipment units of the same type using the equation for adding equal sound pressure levels in Section 3.9.4.1.

Abbreviations:

dBA = A-weighted decibel L_{MAX} = Maximum equivalent sound level (L_{EO}) NA = Not Applicable

Sources: Fernandez 2014f; FHWA 2006a.

Similar to the construction phase, the existing ambient noise level of 59 dBA for Old Urban Residential (from Table 3.9-2) is assumed for the operations phase. Conservative assumptions were made for noise estimates in the absence of a detailed schedule of equipment that might be utilized during the operations phase; i.e., a noise event is assumed to include simultaneous operation of all equipment units listed in Table 3.9-22.

It is anticipated that there would be no major ground-borne vibration-causing equipment utilized during the operations phase at the Bethel Port site; therefore, there would be no vibration impacts at the sensitive receptor associated with this phase.

Table 3.9-25 lists a summary of noise levels during operations at corresponding distances from the Bethel cargo terminal and fuel storage. Note that seasonal port operations activities already exist in the Bethel Port area; however, project-related operations would occur only during the 110-day shipping season. Intensity of noise effects resulting from operations and maintenance activities would start to attenuate from high intensity at receptor distance of 2,000 feet to low intensity at a distance of 1.25-miles or more. Vibration impacts would have no effect even at a distance of 500 feet during port operations activities.

Table 3.9-25: Summary of Noise Levels during Operations at Various Distances to the Bethel Port Site

Project-related Noise Levels at Receptor Location ²							
Receptor Distance	500 Feet	1,000 Feet	1,500 Feet	2,000 Feet	3,000 Feet	1.25 Miles	1.7 Miles
L _{DN} (dBA) ¹	78	72	69	66	63	56	52
Future Ambient Level at Receptor ³ (Project-related + Existing Ambient Level [59 dBA])							
L _{DN} (dBA)	78	72	69	67	64	61	60
Ambient Noise Level Increase at Receptor ³ (Future Ambient Level – Existing Ambient Level [59 dBA])							
Ambient Noise level increase (dBA L _{DN})	19	13	10	8	5	2	1

Notes:

- Noise levels were calculated based on the generic construction equipment list in Table 3.9-15 and using the same calculation methodologies for the mine site construction noise and vibration levels.
 - Project-related noise levels at receptor means the estimated noise levels at receptor location resulting from logarithmic combination of noise generated by construction equipment and existing point source ambient, but not including the receptor's existing ambient level.
 - Ambient noise level increase at a receptor means the arithmetic difference between future ambient noise level at the receptor location (estimated by logarithmic combination of project-related and existing receptor ambient noise levels) and existing ambient level.
- dBA = A-weighted decibel L_{MAX} = Maximum equivalent sound level (L_{EQ})
L_{DN} = Day-Night Sound Level

Sources: Caltrans 2009; FHWA 2006a; FTA 2006.

Closure and Reclamation

The Bethel Port site would be utilized for post-mining reclamation and closure activities, and would remain as a long-term asset after the end of mining. As activities at the port would continue, potential noise impacts at the sensitive receptor would be similar to those discussed under the operations phase above. However, it is assumed that once mine closure and reclamation has been completed, the amount of activity at the port site would decrease.

Dutch Harbor Port Site

Should future activities related to the proposed Donlin Gold Project warrant addition of fuel storage facilities at the Dutch Harbor Port site, construction activities would consist of ground preparation and construction of an additional fuel storage facility. It is assumed that an existing ambient noise level of 59 dBA for Old Urban Residential (from Table 3.9-2) corresponds to the ambient noise level in the Dutch Harbor Port site area, given that the area is more populated than the surrounding rural areas. All activities at the Dutch Harbor Port site would be handled by third parties; therefore, impacts resulting from the Donlin Gold Project would be considered indirect effects.

Information for the nearest sensitive receptor or a roster of noise-producing equipment to be operated during the construction, operations, and closure and reclamation phases of the additional fuel storage at the Dutch Harbor Port site is not available at this time. Assumptions for calculation of noise and vibration levels and the existing ambient noise level at the sensitive receptor would be similar to that of the Bethel Port site. Increase in noise and vibration levels resulting from construction, and operations activities at the Dutch Harbor Port site would be the

same as those shown in Table 3.9-23 and Table 3.9-25, respectively. The Dutch Harbor Port site would be utilized for post-mining closure and reclamation activities, and would remain as a long-term asset after the end of mining. Therefore, potential noise impacts at the sensitive receptor would be similar to the operations phase. However, it is assumed that once mine closure and reclamation has been completed, the amount of activity at the port site would decrease.

Ocean and River Traffic

There would be an increase in barge traffic in the ocean (from Dutch Harbor to Bethel) and Kuskokwim River (from Bethel to Angyaruaq [Jungjuk] Port) from transporting cargo and fuel supplies during the mine site construction, and operations phases. As shown in Table 2.3-7 (Chapter 2, Alternatives), for ocean traffic from Dutch Harbor to Bethel, it would require 14 round trips of fuel shipment, and 16 round trips (during construction phase) and 12 round trips (during operations phase) of cargo shipment per shipping season. For river traffic from Bethel to Angyaruaq (Jungjuk) Port, it would require 122 river round trips from Bethel to Angyaruaq (Jungjuk) Port to transport fuel and cargo to meet the year-round provisions at the mine site during the construction and operations phases. According to an Americas Limited (AMEC) report on River Barge Fleet Design and Operation (2013), it would require a barge fleet of two tows for cargo shipment (32 round trips) and two tows for fuel shipment (29 round trips) to optimize river shipments during the 110-summer days shipping season (AMEC 2013).

There would be no noise impact from additional barge traffic along the ocean route from Dutch Harbor to Bethel as there would be no sensitive receptors present. However, as shown in Table 3.9-12 several communities are located within 1 mile of the Kuskokwim River. At the most, there would be approximately two barge fleets moving on the river during each day of the summer barge season during the construction and operations phases at the mine site, in addition to the existing river traffic volume. Based on the Kuskokwim River noise survey report conducted by Mullins Acoustics in 2005 for the Donlin Gold Project, the noise levels of two barges passing by attenuates to 60 dBA L_{DN} at 50 feet from river bank (Mullins 2005)¹⁶. Table 3.9-26 shows the ambient noise levels along the Kuskokwim River and the resulting noise levels due to two additional river barges at 50 feet distance and at each sensitive receptor within 15 miles along the river.

As shown in Table 3.9-26, noise generated from the river traffic would be low in intensity at the sensitive receptors of Napaimute, Chuathbaluk, Aniak, Lower Kalskag, Upper Kalskag, Tuluksak, Akiak, Akiachak, and Bethel, with increased noise levels ranging from 4 dBA L_{DN} to 9 dBA L_{DN} . There would be no detectable noise impacts on any of the other sensitive receptors along the Kuskokwim River. The noise impacts resulting from river traffic would be present throughout the life of the project, but would be temporary (lasting only through closure), intermittent, and localized at the sensitive receptor.

¹⁶ Kuskokwim River Noise Survey, Site #3 Aniak, two barge passbys noise observation on July 9, 2005 (Mullins 2005).

Table 3.9-26: Kuskokwim River Traffic Noise Impacts During Mine Site Construction and Operations Phases

Sensitive Receptor	Receptor Distance (Feet)	River Noise Levels at 50 Feet (dBA L _{EQ}) ³	Additional Noise from 2 Barges at 50 Feet (dBA L _{EQ})	Total Noise Level at 50 Feet (dBA L _{EQ}) ⁴	Project-related Noise Level at Receptor ⁵ (dBA L _{DN})	Existing Ambient Noise Level at Receptor (dBA L _{DN}) ⁶	Future Ambient Noise Level at Receptor ⁷ (dBA L _{DN})	Ambient Noise Level Increase at Receptor (dBA L _{DN}) ⁸
Crooked Creek	31,152 ¹	40	60	60	10	39	39	0
Napaimute	800 ²	55	60	61	43	39	44	5
Chuathbaluk	686 ¹	55	60	61	45	39	45	6
Aniak	800 ²	47	60	60	42	39	44	5
Lower Kalskag	800 ²	47	60	60	42	39	44	5
Upper Kalskag	475 ¹	47	60	60	47	39	48	9
Tuluksak	950 ¹	45	60	60	41	39	43	4
Akiak	800 ²	45	60	60	42	39	44	5
Akiachak	898 ¹	45	60	60	41	39	43	4
Kwethluk	1,954 ¹	45	60	60	35	39	40	1
Bethel	950 ¹	41	60	60	41	39	43	4
Oscarville	18,955 ¹	41	60	60	15	39	39	0
Napaskiak	23,866 ¹	41	60	60	13	39	39	0
Napakiak	46,200 ¹	41	60	60	7	39	39	0

Notes:

- Distances were determined using GIS spatial analysis tool, ESRI ArcGIS NEAR, which calculates the distance from each point in one feature class to the nearest point or line feature in another feature class.
- Receptor distance to the noise source is conservatively assumed at 800 feet considering the river is about 0.25-miles wide in many locations downstream of the Angyaruaq (Jungjuk) Port site.
- Ambient noise levels are extrapolated at a distance of 50 feet from the river bank, based on noise measurements in the Kuskokwim River (Mullins 2005), using the equation for noise level calculation from a point source moving along a line in Section 3.9.4.1, and converted to dBA L_{EQ}.
- Total noise levels are calculated using the noise equation for adding unequal sound pressure levels in Section 3.9.4.1.
- Project-related noise levels at receptor means the estimated noise levels at receptor location resulting from logarithmic combination of existing point source ambient noise and noise generated by additional barges during construction, and operations at the mine site, but not including the receptor's existing ambient level.
- Existing ambient noise levels at receptor assumed at 39 dBA L_{DN} for Rural Residential (from Table 3.9-2); L_{EQ} is 33 dBA.
- Future ambient noise level at receptor means the logarithmic combination of project-related noise and the existing ambient noise levels at receptor.
- Ambient noise level increase at receptor means the arithmetic difference between future ambient noise level at the receptor location and existing ambient level.

Abbreviations:

dBA = A-weighted decibel

L_{EQ} = Equivalent sound level

L_{DN} = Day-Night Sound Level

Sources: Mullins 2005; Caltrans 2009.

Some degree of ocean and river traffic would continue associated with post-mining reclamation and closure activities. Potential noise impacts at the sensitive receptors would be similar to those discussed under the operations phase above. However, it is assumed that once mine closure and reclamation has been completed, this amount of river and ocean traffic would decrease.

It is anticipated that there would be no major ground-borne vibration-causing equipment operated associated with ocean and river traffic; therefore, there would be no vibration impacts at any of the sensitive receptors.

Summary of Transportation Facilities Impacts

Under Alternative 2, the nearest sensitive receptor for the mine access road, the airstrip, and the Angyaruaq (Jungjuk) Port site is Crooked Creek. The nearest sensitive receptor for traffic on the Kuskokwim River is the community of Upper Kalskag, at a distance of 475 feet. Ambient noise levels from a noise survey conducted along the Kuskokwim River were taken into consideration for these analyses. Existing ambient noise level of 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) was assumed for the sensitive receptors and L_{EQ} was estimated at 33 dBA. Impacts during all phases would be of low intensity (slightly detectable and comparable to natural sounds) due to the distance between the transportation facilities and the sensitive receptors. The duration of impacts would be temporary and intermittent during the construction and closure and reclamation phases, but would be more constant throughout mine site operations, and thus would be considered long-term. All noise and vibration impacts for the transportation facilities would be localized at the sensitive receptors of Crooked Creek and Upper Kalskag. The context would be considered common, as there are no unique or legislatively-protected resources at Crooked Creek or Upper Kalskag. There would be no vibration impacts experienced associated with these transportation facilities under Alternative 2.

Indirect noise effects for the Bethel and Dutch Harbor Port sites construction and operations phases are analyzed in most conservative and ideal-case scenarios, for comparison. The intensity of noise effects at a sensitive receptor resulting from construction activities would start to attenuate from high intensity at a distance of 3,000 feet, to low intensity at a distance of 1.25-miles or more. The duration of impacts would be temporary and intermittent during the construction and closure and reclamation phases, but would be more constant and long-term during the operations phase. Any noise impacts associated with these two ports would be localized at the sensitive receptor. The context would be considered common, as there are no unique or legislatively-protected resources around the Bethel and Dutch Harbor Port sites.

The intensity of vibration impacts associated with the Bethel and Dutch Harbor Port sites would be low (barely perceptible, 8 VdB over the human perception threshold of 65 VdB) even at a sensitive receptor distance of 500 feet during construction, and they would be considered temporary in duration. There would be no vibration impacts expected during the operations or closure and reclamation phases associated with these port sites. Any vibration impacts for these two ports would be localized at the sensitive receptor. The context would be considered common, as there are no unique or legislatively-protected resources within the vicinities of the two port sites.

Table 3.9-27 compiles a summary of noise impacts associated with transportation facilities construction, operations, and closure and reclamation activities under Alternative 2.

Table 3.9-27: Summary of Noise Impacts at Nearest Sensitive Receptor
for the Transportation Facilities

Subcomponent/ Activities	Nearest Sensitive Receptor	Receptor Distance (miles)	Project-related Noise at Receptor (dBA L _{DN})	Ambient Noise Increase at Receptor (dBA L _{DN})
Surface Transportation – Mine Access Road and Material Sites				
Construction	Crooked Creek	5.93	42	5
Operations	Crooked Creek	5.93	31	1
Closure and Reclamation	Crooked Creek	6.64	37	2
Air Transportation – Air Strip				
Construction	Crooked Creek	14.83	40	4
Operations	Crooked Creek	14.83	40	3
Closure and Reclamation	Crooked Creek	14.83	40	3
Water Transportation – Angyaruaq (Jungjuk) Port Site				
Construction	Crooked Creek	5.94	42	8
Operations	Crooked Creek	5.94	45	7
Closure and Reclamation	Crooked Creek	5.94	45	7
Water Transportation – Bethel Port Site				
Construction	Bethel (main town)	1.7	51	2
Operations	Bethel (main town)	1.7	52	3
Closure and Reclamation	Bethel (main town)	1.7	52	3
Water Transportation – Ocean and River Traffic				
Construction	Upper Kalskag	0.09	47	9
Operations	Upper Kalskag	0.09	47	9
Closure and Reclamation	Upper Kalskag	0.09	47	9

Notes:
dBA = A-weighted decibel
L_{DN} = Day-Night Sound Level

3.9.4.3.3 NATURAL GAS PIPELINE

The proposed 315-mile, 14-inch diameter natural gas pipeline (NGP) would extend from the Beluga natural gas pipeline (BPL, an existing pipeline near Beluga, Alaska) to the Donlin Gold mine site. For the purpose of describing noise and vibration impacts, the pipeline component of the proposed project is grouped as follows:

- Mainline, which includes the NGP, temporary construction and operational ROWs, and temporary work areas outside of ROW (access roads, construction camps, pipe and equipment storage yards, material sites, and airstrips); and

- Above-ground facilities, which include the compressor station, the main line block valve stations, metering stations, and pig¹⁷ launching and receiving facilities.

Mainline

The following are factors common to all three project phases (construction, operations, and closure and reclamation) that have been considered for the purposes of noise and vibration impacts analyses for the mainline subcomponent:

- The distances of the nearest sensitive receptors vary for each subcomponent being analyzed; however, the general existing ambient noise level is estimated at 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA.
- The existing ambient noise level at the noise sources (point source) location is conservatively estimated at 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} equivalent estimated at 33 dBA.

Construction

Noise impacts associated with the mainline would occur mainly during the construction phase. Construction-related noise sources would be generated by helicopter traffic, diesel-powered mobile equipment, pipe installation equipment, equipment operating at material sites, and blasting (in the event it would be necessary). Increased noise levels would vary depending on the construction stage, and would be localized and transitory as construction activity proceeds at various locations along the length of the pipeline. Noise impacts for specific construction activities are described below.

The overall project schedule for construction of infrastructure build out, pipe installation and ROW stabilization, rehabilitation and reclamation work concurrent and immediately following pipe installation would take place over a period of 3 to 4 years. The first year would involve ROW civil work and mobilization of material and equipment, including clearing of vegetation (as applicable), preliminary civil construction of access roads, airstrips, barge landings, pipe storage yards, construction campsites, etc. The pipeline installation would occur for a period of about 2 to 3 years.

Table 3.9-28 shows a list of equipment operated for a typical pipeline construction section, the corresponding noise levels, and schedule of operation, grouped according to construction activity. Because noise impacts and affected sensitive receptors vary with specific construction activities undertaken at a certain period of time, the environmental consequences are discussed according to the impacts resulting from each of the pipeline major construction activities, as described below.

¹⁷ Pig refers to a mechanical tool used to clean and/or inspect the interior of a pipeline.

Table 3.9-28: Major Noise Sources and Noise Levels for Construction of Pipeline

Equipment ¹	Maximum Noise Levels, L _{MAX} at 50 Feet (dBA) ^{2, 3}	Schedule/Period of Use
General Activities and Utility Equipment		
Bus	55	Winter and Summer
Pickup	55	Winter and Summer
Air Compressor 450 cfm	80	Winter and Summer
Ambulance	55	Winter and Summer
Backhoe Rubber-Tired	80	Winter and Summer
Field Office Trailer & Equip	84	Winter and Summer
Flatbed Truck 1 ton	84	Winter and Summer
Flatbed Truck 5 ton	84	Winter and Summer
Fork Lift 992	85	Winter and Summer
Frontend Loader 966	80	Winter and Summer
Fuel Truck	84	Winter and Summer
Generator - 100 kw	82	Winter and Summer
Generator - 50 kw	82	Winter and Summer
Grease Truck	84	Winter and Summer
Helicopter	1104	Winter and Summer
Loader, CAT IT-28	80	Winter and Summer
Light Plant- Tower	82	Winter
Mechanic Rig	80	Winter and Summer
Morooka Carrier	85	Winter and Summer
Tire Truck	84	Winter and Summer
Tractor w/Float	84	Winter and Summer
Tractor w/Lowboy	84	Winter and Summer
Water Pump - 2"	82	Winter and Summer
Winch Truck	84	Winter and Summer
Civil Construction		
Backhoe 330	80	Winter and Summer
Backhoe 345	80	Winter and Summer

Table 3.9-28: Major Noise Sources and Noise Levels for Construction of Pipeline

Equipment ¹	Maximum Noise Levels, L _{MAX} at 50 Feet (dBA) ^{2, 3}	Schedule/Period of Use
Chain Trencher	85	Winter and Summer
Chisel Plow	84	Winter and Summer
Crane LS-98A (35 ton)	85	Winter and Summer
Sub. Trash Pump - 3"	82	Winter and Summer
Sub. Trash Pump - 4"	82	Winter and Summer
Sub. Trash Pump - 6"	82	Winter and Summer
Wheeled Hydro Ax	85	Winter and Summer
Wood Chipper	85	Winter and Summer
Tracked Feller/Buncher	85	Winter and Summer
Wheeled Feller/Buncher	85	Winter and Summer
Drilling and Blasting		
John Henry Drill (for drill)	85	Winter and Summer
John Henry Drill (for blast)	94	Winter and Summer
Ice Road Construction and Maintenance		
D5G Mulchers	85	Winter
Cat D6 LGP Dozer	85	Winter
Tracked Excavators	85	Winter
Tracked Feller/Buncher	85	Winter
Tracked carriers	85	Winter
Cat 977	80	Winter
Trail Groomers	85	Winter
Snowmachines	85	Winter
Water tanker	85	Winter
Fork Lifts-980	85	Winter
Ice Making Machine	85	Winter
Water Truck 4000 gal	84	Winter
Pipe Laying		
Bending Machine 6-20	80	Winter and Summer

Table 3.9-28: Major Noise Sources and Noise Levels for Construction of Pipeline

Equipment ¹	Maximum Noise Levels, L _{MAX} at 50 Feet (dBA) ^{2, 3}	Schedule/Period of Use
Beveling Machine	85	Winter and Summer
Booster Air Compressor	80	Winter and Summer
Buffing Machine	73	Winter and Summer
Challenger with Welding Shelter	85	Winter and Summer
Commander w/Pole Trailer	84	Winter and Summer
Preheat Tractor D6	84	Winter and Summer
Ditch Witch (for ECD installation)	85	Winter and Summer
Sandblasting Rig	85	Winter and Summer
Sideboom 561	84	Winter and Summer
Sideboom 571	84	Winter and Summer
Sideboom 572	84	Winter and Summer
Sideboom 583	84	Winter and Summer
Skid Truck	84	Winter and Summer
Tractor w/Pole Trailer	84	Winter and Summer
Vacuum Hoe 345	80	Winter and Summer
Welding Rig	73	Winter and Summer
Welding Tractor D6	84	Winter and Summer
River Crossings and HDD		
Crane LS-318 (60 ton)	85	Winter and Summer
Crew Boats	74 ⁵	Summer
Drill Rig and supporting equipment (Mud pump, Fluid System & Tank, Power unit and control Trailer, Crane or Backhoe)	81 ⁶	Estimate Construction Duration: Skwentna River - 14 days Happy River - 22 days Kuskokwim River - 55 days E. Fork of George River - 28 Days N Fork of George River - 10 Days George River - 19 days Dalzell Gorge - 73 days duration
Backfilling and Ground Restoration		
Dump Truck	84	Winter and Summer

Table 3.9-28: Major Noise Sources and Noise Levels for Construction of Pipeline

Equipment ¹	Maximum Noise Levels, L _{MAX} at 50 Feet (dBA) ^{2, 3}	Schedule/Period of Use
Dozer D6	85	Winter and Summer
Dozer D7	85	Winter and Summer
Dozer D8	85	Winter and Summer
Motor Grader 14G	85	Winter and Summer
Motor Grader 16	85	Winter and Summer
Farm Tractor	84	Summer
Farm Tractor - Harrow	84	Summer
Farm Tractor - Spreader	84	Summer
Pipe Cleaning, Pressure Testing and Drying		
Cleaning and Caliper Pigs	80 ⁷	Winter
Air Compressor 1750 cfm; Hydro Fill & Test Package		Summer

Notes:

- Equipment lists are as provided in Fernandez 2014f.
- The noise levels listed represent the A-weighted maximum sound level (L_{MAX}) (per equivalent equipment specifications provided in FHWA RCNM version 1.1) measured at a distance of 50 feet from the construction equipment.
- Noise levels are equivalent default values from FHWA RCNM version 1.1, unless as otherwise noted.
- Assumed conservative noise level based on maximum allowable limit for helicopters of 110 dBA measured 394 feet above ground during flyover, per Title 14 CFR Part 36, Appendix H. Extrapolated noise level of 110 dBA at reference distance of 394 feet above ground would still be 110 dBA when extrapolated at 50 feet lateral distance from the reference point. See Section 3.9.2 under *Airstrip*.
- Extrapolated noise level at 50 feet based on reference sound levels for a motorboat at 68 dBA (L_{MAX}) at 100-foot distance (Mullins 2005).
- Extrapolated noise level at 50 feet based on estimated sound power level of 115 dBA for typical HDD construction activities (Burge and Kiteck 2009).
- No data available for pipeline pigging noise level; assumed noise level of a compressor to be conservative.

Abbreviations:

dBA = A-weighted decibel L_{MAX} = Maximum equivalent sound level (L_{EQ})

Sources: Fernandez 2014f; ARCADIS 2013a; FHWA 2006a; Mullins 2005.

Civil Construction and General Activities

Noise sources from civil construction activities would include heavy equipment operations for ground preparation, vegetation clearing and grading, ROW preparation, ditch excavation, construction of temporary work areas (access roads, airstrips, barge landings, pipe storage yards, construction campsites), and other general construction activities related to support facilities to prepare for the pipeline installation and operations. Noise from project-related helicopter traffic would also contribute to temporary increases in noise levels around the construction site.

As shown in Table 3.9-13, the nearest community to the pipeline construction site is the village of Farewell (1.92 miles away). Commercial lodges located within 5 miles of the proposed ROW

within pipeline MP 50 and MP 170 (within the villages of Farewell and Skwentna) have also been identified, as shown in Table 3.9-29 (SRK 2013b).

Table 3.9-29: Commercial Lodges within Five Miles of Proposed Pipeline Corridor

Name of Lodges/Nearest Sensitive Receptor	Operational Season/Notes	Distance from Alignment (Miles)	Estimated Noise Levels at NSR (dBA L _{DN})
TalVista Lodge	Summer/Winter	1.8	50
Talaview Lodge	Summer	1.8	50
TalStar Lodge	Summer	1.9	50
Talachulitna River Lodge	Summer	1.9	50
Shell Lake Lodge	Winter (Summer business is fly-in only)	1.8	50
Winter Lake Lodge	Summer/Winter	0.8	56
Rainy Pass Lodge	Summer/Winter	0.6	58
Farewell Lake Lodge	Inactive (lodge and out buildings burned in 2010)	4.4	46
Alaska Adventure Vacations*	Seasonal recreation camp	0.8	56
Hunting guide outfitter operation	Commercial occupancy lease and associated airstrip	1	54
Commercial hunting camp, LAS 27588	Commercial guiding	1.1	53
Commercial recreation camp, LAS 29232	Commercial guiding	1.1	53

Notes:

dBA = A-weighted decibel

L_{DN} = Day-Night Sound Level

Sources: SRK 2013b; FHWA 2006a.

As shown in Table 3.9-29, the nearest sensitive receptor to the natural gas pipeline corridor would be the Rainy Pass Lodge (0.6 miles away). Noise estimates are calculated based on the two loudest equipment units from the list in Table 3.9-28 (under Civil Construction and General Activities). Each of the two loudest equipment units from the list has a noise level of 85 dBA at 50 feet. During the construction phase, the estimated project-related noise level and the resulting noise levels at Rainy Pass Lodge would be approximately 58 dBA L_{DN}, an increase of 19 dBA L_{DN} compared to the existing ambient level. These impacts would be considered high intensity, but would be temporary in duration, (only taking place during the construction season at that location) and intermittent (not occurring continuously at the same location), throughout that phase. The exact noise levels would depend on the number and type of noise sources operating at the same time from the same reference distance. In addition, aircraft fly-overs would also cause temporary, intermittent noise level increases at Rainy Pass Lodge. However, because the flight routes and vertical aircraft distances are unknown at this time, resulting noise levels during a fly-over at Rainy Pass Lodge could not be estimated.

Other than drilling and blasting activities that could occur at some material sites, there are no anticipated major ground-borne vibration-causing equipment that would be operated during civil construction and general activities. Therefore, for a typical pipeline construction section where no drilling and blasting activities occur, there would be no vibration impacts experienced at the nearest sensitive receptor.

Drilling and Blasting

Blasting may be required in some material sites, such as Kusko West (MP 240.7), where bedrock sources would be used for gravel fill for road, work area or pad construction, or the Threemile airstrip, (MP 111.8). These areas are in remote locations with no permanent sensitive receptors. Exact locations for blasting activities have not yet been established. Blasting needs would be determined during the final construction design, and the blasting plan would be developed in accordance with state and federal regulatory requirements.

Given that blasting would most likely occur in material sites, the nearest sensitive receptor to a material site would be the village of Farewell, at a distance of 2.26 miles (see Table 3.9-13). Using the maximum noise levels generated by the equipment listed under Drilling and Blasting in Table 3.9-28, the estimated project-related noise level during this event would be 35 dBA L_{DN} . The resulting noise levels at the sensitive receptor (Farewell) would be approximately 41 dBA L_{DN} , an increase of 2 dBA L_{DN} compared to the existing ambient level. Maximum noise levels could reach up to 44 dBA L_{MAX} but would be temporary, only lasting for a few seconds per event. This noise level at the village of Farewell would be perceived as extremely low in intensity, temporary, localized, and common in context.

Assuming a vibration level of 100 VdB at 50 feet (for Blasting from Table 3.9-16, the estimated vibration level at the sensitive receptor (Farewell) would be less than 29 VdB, which would be well below the FTA threshold for human perception of 65 VdB (from Table 3.9-5) and damage threshold for fragile buildings of 0.12 in/sec PPV (from Table 3.9-6).

Ice Access Roads

Ice access roads would be needed for winter use to provide access to the pipeline corridor directly from the road system, to facilitate delivery of construction equipment and supplies, as well as to expedite completion of pipeline installation. Donlin Gold proposes to develop two primary winter route options to be used for a period of approximately 3 years: (1) the Oilwell Road route accessed via the Parks Highway to Petersville Road then to Oilwell Road, and (2) the Willow Landing route accessed from the Parks Highway at Willow via Willow Creek Parkway.

Noise estimates for pipeline ice access road construction and maintenance are calculated based on the two loudest equipment units from the list in Table 3.9-28 (under Ice Road Construction and Maintenance). Each of the two loudest equipment units from the list has a noise level of 85 dBA at 50 feet. The nearest sensitive receptor to the ice access roads would be the village of Farewell (see Table 3.9-13), located about 1.90 miles away. The estimated project-related noise level during construction would be 48 dBA L_{DN} . The resulting noise levels at Farewell would be approximately 49 dBA L_{DN} , an increase of 10 dBA L_{DN} compared to the existing ambient level. This noise level experienced at the sensitive receptor of Farewell would be perceived as low in intensity, temporary (only present during the construction phase), localized, and common in context.

It is anticipated that there would be no major ground-borne vibration-causing equipment operated for ice access road construction; therefore, there would be no vibration impacts experienced at the nearest sensitive receptor (Farewell).

Pipe Laying

The pipeline installation would take place for a period of about 2 to 3 years. There would be two main construction spreads: Spread 1 on the western end of the pipeline, from MP 127 to MP 315; and Spread 2 on the east side from MP 127 to MP 0. Each of the spreads would be divided into sections, with each section scheduled for construction during the winter or summer season. About 68 percent of the 315-mile pipeline construction would occur during the winter season and 32 percent during the summer season. The majority of the pipeline would be buried, using trenches or HDD. There would be two above-ground pipeline sections, each approximately 1,400 feet in length, crossing the Castle Mountain and the Denali-Farewell faults.

Noise estimates for pipe laying are calculated based on the two loudest equipment units from the list in Table 3.9-28 (under the Pipe Laying group). Each of the two loudest equipment units from the list has a noise level of 85 dBA at 50 feet. As shown in Table 3.9-29, the nearest sensitive receptor from the natural gas pipeline route is the Rainy Pass Lodge (0.60 miles away). The estimated project-related noise level during this event and the resulting noise level at the sensitive receptor (Rainy Pass Lodge) would be 58 dBA L_{DN} , an increase of 19 dBA L_{DN} compared to the existing ambient level. These impacts would be considered high intensity, but would be temporary (only taking place during one construction season at that location) and intermittent (not occurring continuously at the same location) throughout that phase. The exact noise levels would depend on the number and type of noise sources operating at the same time from the same reference distance.

It is anticipated that there would be no major ground-borne vibration-causing equipment operated during pipe laying; therefore, there would be no vibration impacts felt at Rainy Pass Lodge under Alternative 2.

River Crossings and HDD

The HDD technique would be used to bury the pipeline at stream and river crossings. Six river crossings are currently proposed as HDD crossings under Alternative 2: Skwentna River, Happy River, Kuskokwim River, East Fork of the George River, George River, and the North Fork of the George River.

The sound power level for typical HDD construction activities at the entry site¹⁸ is estimated at 115 dBA (Burge and Kiteck 2009). The nearest sensitive receptor to HDD construction activities would be the community of Skwentna, located 8.69 miles away from the HDD site at the Skwentna River. Taking into account the existing ambient noise level at the point source, and noise generated from operations of HDD and associated equipment listed in Table 3.9-28 (under River Crossings and HDD group), the estimated project-related noise level during HDD construction activities would be 25 dBA L_{DN} . The resulting noise levels at the sensitive receptor (Skwentna) would be approximately 40 dBA L_{DN} , an increase of 1 dBA L_{DN} compared to the

18 The noise levels generated at the HDD exit side operations (assuming no HDD rig employed) is generally lower than the noise generated at the HDD entry side, estimated to be 10 to 15 dB lower than the noise generated at the HDD entry site (Burge and Kiteck, 2009). The sound power level of HDD at 115 dBA is extrapolated to 81 dBA at 50 feet, using the equation in Section 3.9.4.1 for calculating noise attenuation from one distance to another.

existing ambient level. This noise level would be perceived as extremely low in intensity, temporary, localized, and common in context.

Ground-borne vibration could also occur in the immediate vicinity of HDD construction activities, particularly if rock drilling or pile driving is required. Using highest vibration level of 112 VdB at 25 feet (for pile driver, impact type) from Table 3.9-16 as a conservative assumption, the estimated vibration level at the sensitive receptor (Skwentna) from HDD construction equipment would be about 14 VdB, which is well below the FTA threshold for human perception of 65 VdB (from Table 3.9-5) and damage threshold for fragile buildings of 0.12 in/sec PPV (from Table 3.9-6).

Pipeline Cleaning, Pressure Testing, and Drying

Before the pipeline is put into service, the entire pipeline would be cleaned of construction debris using a cleaning pig(s), pressure tested in compliance with USDOT regulations (49 CFR Part 192) to verify its integrity and ability to withstand maximum operating pressures, and dried using multiple runs of foam swab pigs using compressors and a dehydrator.

The nearest sensitive receptor to the natural gas pipeline route would be the Rainy Pass Lodge (0.60 miles). Using the maximum noise levels generated by the equipment listed under Pipe Cleaning, Pressure Testing and Drying in Table 3.9-28, the estimated project-related noise level during this event would be 46 dBA L_{DN} . The resulting noise levels at the sensitive receptor (Rainy Pass Lodge) would be approximately 47 dBA L_{DN} , an increase of 8 dBA L_{DN} compared to the existing ambient level. Maximum noise levels could reach up to 44 dBA L_{MAX} . Noise impacts would be considered low in intensity (detectable), occurring intermittently during the construction phase.

There would be no major ground-borne vibration-causing equipment operated during pipeline cleaning, pressure testing, and drying activities; therefore, there would be no vibration impacts at Rainy Pass Lodge.

Operations and Maintenance

Noise impacts during the operations phase of the pipeline vary depending on the activities undertaken and the distance to the sensitive receptor, as discussed below. The nearest sensitive receptor to the natural gas pipeline route is the Rainy Pass Lodge (0.60 miles).

There would be no major ground-borne vibration-causing equipment operated associated with pipeline operations; therefore, there would be no resulting vibration impacts at the sensitive receptor (Rainy Pass Lodge) during this phase.

Pipeline Operations and Maintenance

There would be no major noise-producing sources along the natural gas pipeline corridor during pipeline operations. Gas traveling through the buried pipeline would neither emit audible noise nor cause a perceptible level of vibration at potentially sensitive receivers. The estimated noise levels at the sensitive receptor resulting from operations of the pipeline would remain at 39 dBA L_{DN} ; therefore there would be no noise impacts associated with pipeline operations under Alternative 2.

Periodic Pipeline Maintenance and Inspection

Periodic maintenance and routine inspection activities would be conducted on the mainline. Pipeline maintenance and inspection schedule would be addressed in the final Operations and Maintenance (O&M) Plan/ Manual and Pipeline Surveillance and Monitoring Plan. During maintenance and routine inspection, noise sources would include in-line inspection tools (pigs). At the nearest sensitive receptor to the pipeline (Rainy Pass Lodge), noise impacts from the pigging processes would be similar to that of the pipeline cleaning, pressure testing, and drying activities as described above. project-related noise level during this event would be 46 dBA L_{DN} . The resulting noise levels at Rainy Pass Lodge would be approximately 47 dBA L_{DN} , an increase of 8 dBA L_{DN} compared to the existing ambient level. Noise impacts would be considered low in intensity (slightly detectable) and temporary in duration, occurring intermittently throughout operations.

Pipeline ROW Maintenance and Safety Inspection

As part of maintenance and safety procedures, the pipeline ROW would be cleared of brush at approximately 10-year intervals, or as required to preserve pipeline integrity and access. This action would also be addressed in the final O&M Plan/Manual and Pipeline Surveillance and Monitoring Plan.

Table 3.9-30 shows a list of equipment operated for a typical ROW clearing and the corresponding noise levels. This list represents an estimate of maximum operating units at one time.

Table 3.9-30: Major Noise Sources and Noise Levels for Maintenance of Pipeline ROW

Equipment ¹	Number of Units ¹	Acoustical Usage Factor (%) ²	Maximum Noise Levels per Unit, L_{MAX} at 50 Feet (dBA) ^{3, 4}	Total Noise Levels, L_{MAX} at 50 Feet (dBA) ⁵
Motor Grader 14G	5	50	85	92
Motor Grader 16	1	50	85	85
Wheeled Hydro Ax	2	50	85	88
Wood Chipper	1	50	85	85
Tracked Feller/Buncher	1	50	85	85

Notes:

- Equipment lists and numbers of units are as provided in Fernandez 2014f.
- Acoustical usage factor (equivalent default values provided in FHWA RCNM version 1.1) is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation.
- The noise levels listed represent the A-weighted maximum sound level (L_{MAX}) (per equivalent equipment specifications provided in FHWA RCNM version 1.1) measured at a distance of 50 feet from the construction equipment.
- Noise levels are equivalent default values from FHWA RCNM version 1.1.
- Estimated total noise levels emitted by multiple equipment units of the same type using the equation for adding equal sound pressure levels in Section 3.9.4.1.

dBA = A-weighted decibel L_{MAX} = Maximum equivalent sound level (L_{EQ})

Sources: Fernandez 2014f; FHWA 2006a.

The estimated project-related noise level from pipeline ROW maintenance and safety inspection activities, and the resulting noise levels at Rainy Pass Lodge would be 59 dBA L_{DN} , an increase of 20 dBA L_{DN} compared to the existing ambient level. Maximum noise levels could reach up to 56 dBA L_{MAX} . These impacts would be considered high intensity, localized at the sensitive receptor, but would be temporary in duration (only lasting during the maintenance and safety activities, and occurring once every 10 years). The exact noise levels would depend on the number and type of noise sources operating at the same time from the same reference distance.

Closure and Reclamation

The annual reclamation functions and schedule of activities to be performed following construction would be identified as part of the Stabilization, Rehabilitation and Reclamation Plan, which would be developed during final project design. This plan would address the annual follow-up reclamation functions and schedule of activities to be performed following construction, as well as reclamation activities at project closure. Noise impacts for each closure and reclamation event are described below.

There would be no major ground-borne vibration-causing equipment operated during closure and reclamation activities; therefore, there would be no resulting vibration impacts at the sensitive receptor (Rainy Pass Lodge).

Reclamation after Construction

After the construction phase, all disturbed areas (such as the ROW, temporary construction camps, pipe storage yards, material sites, airstrips, roads, barge landings, and other temporary use areas) would be cleaned up, stabilized, prepared for natural revegetation, and reclaimed to their original state. Noise estimates are calculated based on the two loudest equipment units from Table 3.9-28 (under the Backfilling and Ground Restoration group). The two loudest equipment units from the table each have a noise level of 85 dBA at 50 feet.

The estimated project-related noise level generated from reclamation activities after construction and the resulting noise levels at the sensitive receptor (Rainy Pass Lodge) would be 58 dBA L_{DN} , an increase of 19 dBA L_{DN} compared to the existing ambient level. These impacts would be considered high intensity, but would be temporary (only taking place during one construction season at that location) and intermittent (not occurring continuously at the same location), lasting for short periods only throughout reclamation. The exact noise levels would depend on the number and type of noise sources operating at the same time from the same reference distance. In addition, an aircraft fly-over would also cause temporary increases in noise levels at the Rainy Pass Lodge. However, because the flight routes and vertical aircraft distances are unknown at this time, resulting noise levels during a fly-over at the Rainy Pass Lodge could not be estimated.

Reclamation at Pipeline Closure

All below grade pipe and HDDs would be abandoned in place at pipeline closure. The aboveground sections of the pipeline, the pipes that transition from above grade to below grade, and the piles that provide support for the horizontal beams at the fault crossings would be cut and hauled away for recycling. Noise due to reclamation activities during closure would be generated from purging of natural gas by pigging with a cleaning pig, and from small hand tools used to cut aboveground sections of the pipeline.

At the nearest sensitive receptor (Rainy Pass Lodge), noise impacts from the pigging processes would be similar to that of pipeline cleaning, pressure testing, and drying activities as described above. project-related noise level during this event would be 46 dBA L_{DN} . The resulting noise levels at Rainy Pass Lodge would be approximately 47 dBA L_{DN} , an increase of 8 dBA L_{DN} compared to the existing ambient level. This noise level would be perceived at the sensitive receptor as low in intensity (slightly detectable) and temporary in duration (lasting only through project closure and reclamation phase, and intermittent based on the activity).

Temporary, intermittent noise impacts from helicopter traffic used to transport personnel to and from the pipeline would also be expected. However, because the flight routes and vertical aircraft distances are unknown at this time, resulting noise levels during a fly-over at Rainy Pass Lodge could not be estimated.

Pipeline Above-ground Facilities

Pipeline above-ground facilities consist of a compressor station, metering stations, mainline valves, and pig launcher and receiver stations. Noise and vibration impacts for each of these facilities are described below. Once the above-ground facilities are commissioned and operating normally, the new ambient sound level at the sites would be measured as a logarithmic sum of background and proposed project noise.

The following factors used in the noise and vibration impact analysis are common to construction, operations, and closure and reclamation phases for the pipeline above-ground facilities:

- The distances of the nearest sensitive receptors vary for each subcomponent being analyzed; however, the general existing ambient noise level is estimated at 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA.
- The existing ambient noise level at the nearest noise sources (treated as an aggregate point source for purposes of this analysis) location is estimated at 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA.

Compressor Station

A single compressor station would be needed to boost the gas pressure for delivery to the proposed Donlin Gold mine site. The compressor station would be built at pipeline MP 0.4 on a 1.5-acre lot. Three electrically powered 1,000-Hp natural gas compression machines, each with an outdoor fin-fan cooler, would be used: two would serve as main compressors to meet current design flow conditions, and one compressor would serve as a backup unit. The station would be unmanned with fully automated equipment operated by a remote-control system, and would be electrically powered by the Chugach Electric Association power plant at Beluga. In addition, the station would also have a pig launcher and a mainline block valve (as an emergency shutdown [ESD] or blowdown valve) on the site.

The nearest sensitive receptor to the compressor station would be the community of Beluga (12.43 miles away). Noise impacts during the construction of the compressor station would be generated during operations of heavy construction equipment. Noise and vibration calculation methodologies and assumptions would be in accordance with the FTA guidance on general assessment for noise impacts (FTA 2006). Noise estimates are calculated based on the two loudest equipment units from Table 3.9-15; the two loudest units have noise levels of 85 dBA

and 90 dBA at 50 feet. The estimated project-related noise levels from construction activities at the sensitive receptor (Beluga) would be 35 dBA L_{DN} . The resulting noise levels at Beluga, including the existing ambient noise, would be approximately 41 dBA L_{DN} , an increase of 2 dBA L_{DN} compared to the existing ambient level. These impacts would be localized at the sensitive receptor and experienced as low in intensity (no perceivable change in existing ambient noise levels), and would be temporary in duration (lasting only through the construction phase, and intermittent based on the equipment usage).

The estimated vibration level associated with the construction of the compressor station would be 17 VdB, which would be well below the FTA threshold for human perception of 65 VdB (from Table 3.9-5) and damage threshold for fragile buildings of 0.12 in/sec PPV (from Table 3.9-6).

Noise generated at the compressor station during the operations phase would originate mainly from operation of two compressor machines and electric motors, fin-fan coolers, blowdown processes, and pipeline pig(s). The compressors and electric motors would be housed inside buildings or provided enclosures to reduce noise emissions.

Pipeline pigging is needed for maintenance and testing, and is generally a less frequent occurrence for a natural gas pipeline than for an oil production pipeline; most likely it will be performed on an annual basis. The noise from pipeline pigging would be transient in nature, and would only occur at the pig trap and the short above-ground pipe segment.

The noise from pipeline blowdown would be a "rare event" scenario, as it would only occur during an emergency pressure relief or blowdown due to an incident requiring a major repair on a pipeline segment or compressor station equipment. Noise from a pipeline blowdown would be loud and transient lasting for several minutes until the pressure has been relieved.

Table 3.9-31 shows noise levels of equipment operated at the compressor station with and without enclosures (Mullins 2013).

For conservative noise impact analysis, noise generated is assumed to include simultaneous operation of all equipment listed in Table 3.9-31. The estimated project-related noise level during this phase would be 30 dBA L_{DN} . The resulting noise levels at the sensitive receptor (Beluga), including the existing ambient noise, would be approximately 40 dBA L_{DN} , an increase of 1 dBA L_{DN} compared to the existing ambient level. This noise level would not create a perceivable change in the existing ambient noise level. Maximum noise levels could reach up to 34 dBA L_{MAX} but would be temporary in duration.

There is no anticipated major ground-borne vibration-causing equipment that would be operated during operations of the compressor station. Therefore, the vibration impacts resulting from these activities on the nearest sensitive receptor would not constitute an impact.

Reclamation activities at the compressor station would take place after construction and at project closure, in accordance with the Donlin Gold Stabilization, Rehabilitation and Reclamation Plan. Ground disturbances would be graded and stabilized after construction of facilities. At closure, all equipment located at the compressor station would be dismantled and transported to Anchorage for salvage, recycling, or disposal as appropriate.

Table 3.9-31: Major Noise Sources for the Compressor Station and Noise Levels During Operations

Noise Source	Number of Units	Total Noise Levels at 50 Feet With Enclosure (dBA L_{MAX})	Total Noise Levels at 50 Feet Without Enclosure (dBA L_{MAX})
Electric motors and compressors	2	49 ³	86 ^{3,4}
Fin-fan coolers	2	64 ³	86 ^{3,4}
Blowdown ¹	1	NA	90 ³
Pipeline pig ²	1	NA	80 ⁵

Notes:

- Pipeline blowdown would only occur during an emergency that requires a major pipeline segment or compressor station equipment repair. Adding a muffler to the gas discharge could dramatically reduce blowdown noise.
- Pigging for natural gas pipeline is expected to be done approximately on an annual basis for normal operation.
- Noise levels at 100 feet for equipment listed in Table 3.9-31 are provided in Mullins (2013). Noise levels at 50 feet are estimated using the equation for calculating noise level from a point source with respect to a known noise level at a known or reference distance in Section 3.9.4.1.
- Total noise levels emitted by multiple equipment units of the same type are estimated using the equation for adding equal sound pressure levels in Section 3.9.4.1.
- No data available for pipeline pigging noise level; assumed noise level of a compressor to be conservative.

Abbreviations:

dBA = A-weighted decibel

L_{MAX} = Maximum equivalent sound level (L_{EQ})

NA = Not Available

Source: Mullins 2013.

The estimated project-related noise level during this phase would be 32 dBA L_{DN} . The resulting noise levels at the sensitive receptor (Beluga), including the existing ambient noise, would be approximately 40 dBA L_{DN} , an increase of 1 dBA L_{DN} compared to the existing ambient level. This noise level would not create a perceivable change in the existing ambient noise level. Impacts would be temporary in duration, lasting only through the closure and reclamation phase.

There would be no major ground-borne vibration-causing equipment operated during operations or closure and reclamation activities at the compressor station; therefore, there would be no resulting vibration impacts at the sensitive receptor (Beluga).

Metering Stations

Metering stations would be located at the BPL tie-in (MP 0) and at the pipeline terminus (MP 315) at the mine site. Each of these stations would also have a mainline block valve and a pig launcher (MP 0) and receiver (MP 315). Noise and vibration impacts would not be anticipated due to operations of metering facilities. However, for the conservative analysis, and because the metering stations would be collocated with other noise sources (blowdown and pipeline pig), noise and vibration impacts are analyzed from the pipeline terminus metering station (MP 315).

Noise and vibration impacts during the construction, operations, and closure and reclamation of the metering stations would be similar to that of the compressor station, as discussed above, except as follows:

- The nearest sensitive receptor would be Crooked Creek, located 10.09 miles from the metering station at MP 315.
- The noise sources do not include fin-fan coolers, compressors, or electric generators.
- The context associated with any impacts resulting from the metering station at MP 315 would be common; Crooked Creek does not have unique or legislatively-protected resources.

The estimated project-related noise levels during the construction, operations, and closure and reclamation phases at the MP 315 metering station would be 37 dBA L_{DN} , 29 dBA L_{DN} , and 34 dBA L_{DN} , respectively. The resulting noise levels at the sensitive receptor (Crooked Creek) including the existing ambient noise would be 41 dBA L_{DN} , 40 dBA L_{DN} , and 40 dBA L_{DN} , an increase of 2 dBA L_{DN} (construction), 1 dBA L_{DN} (operations), and 1 dBA L_{DN} (closure and reclamation), compared to the existing ambient level. The resulting noise levels at Crooked Creek would not create a perceivable change in the ambient noise level and no vibration impacts are anticipated.

Mainline Block Valve Stations

Mainline block valves (MLV) would be placed at no more than 20-mile intervals along the pipeline route, with a total of 20 MLVs. There would be one MLV constructed at each of the following locations: the BPL tie-in (MP 0), the compressor station (MP 0.4), the Farewell pig launcher/receiver site (MP 156), and the pipeline terminus at the mine site (MP 315). The remaining 16 MLVs would be manually operated and noise impacts from these sites would be minimal. For the conservative impacts assessment, noise and vibration levels for the MLV stations are analyzed from the Farewell pig launcher/receiver site (MP 156) with the nearest sensitive receptor (Farewell) located 7.90 miles away. Ambient noise levels are estimated at 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential).

The estimated project-related noise levels associated with MLVs during construction, operations, and closure and reclamation would be 38 dBA L_{DN} , 31 dBA L_{DN} , and 36 dBA L_{DN} , respectively. The resulting noise levels at the sensitive receptor (Farewell), including the existing ambient noise, would be 42 dBA L_{DN} , 46 dBA L_{DN} , and 46 dBA L_{DN} , an increase of 3 dBA L_{DN} , 7 dBA L_{DN} , and 7 dBA L_{DN} during the construction, operations, and closure and reclamation phases, respectively, compared to the existing ambient level. Noise impacts at the nearest sensitive receptor would be low in intensity and temporary in duration (noise impacts would not be constant through the life of the project, and would only occur during rare events or annual pigging). No vibration impacts are anticipated.

Pig Launcher/Receiver Stations

Pig launchers and receivers would be strategically located along the pipeline route to be used for pipeline maintenance (maintenance pigs) and inline inspection pigs (smart pigs). There would be six pig launchers and receivers for the pipeline component: three launchers, with one at the BPL tie-in (MP 0), the compressor station (MP 0.4), and the Farewell launcher/receiver site (MP 156); and three receivers, with one at the compressor station, the Farewell launcher/receiver site, and the pipeline terminus at the Donlin Gold mine site (MP 315).

For conservative impact assessment, noise and vibration levels for the pig launcher/receiver stations are analyzed from the Farewell pig launcher/receiver site at MP 156, the same location

as that of the MLV described above, with the nearest sensitive receptor (Farewell) located 7.90 miles away. Therefore, noise levels and vibration impacts for the pig launcher/receiver station during the construction, operations, and closure and reclamation phases would be similar to that of the MLV, as discussed above. Noise impacts at the sensitive receptor would be low intensity and temporary in duration. No vibration impacts are anticipated.

Summary of Natural Gas Pipeline Impacts

Noise impacts along the pipeline during construction, operation, and closure and reclamation activities under Alternative 2 would range from low intensity (e.g., ice road construction, pipeline operations) to high intensity (e.g., pipeline construction and pipe laying), depending on the location of the activities. The nearest sensitive receptor to the pipeline corridor is the Rainy Pass Lodge (0.60 miles away). Noise impacts would be high intensity at this sensitive receptor during construction, pipe laying and periodic pipeline maintenance, but would be temporary in duration (only taking place during one construction or closure and reclamation phases at that location) or intermittent, occurring once every several years throughout the operations phase. The exact noise levels would depend on the number and type of noise sources operating at the same time from the same reference distance. Impacts would be localized at the sensitive receptor, and would be common in context.

For other associated pipeline activities such as drilling and blasting, ice road construction and maintenance, and river crossings and HDD activities, the sensitive receptors are all located at distances where noise levels would be perceived as low intensity (comparable to natural sounds), local in extent (at the sensitive receptor), and common in context. The duration of impacts would be temporary (lasting only for the construction and closure and reclamation phases).

Noise impacts from the construction, operation, and closure and reclamation activities associated with above-ground pipeline facilities would be low intensity at each of the sensitive receptors, local in extent, and considered common in context. The duration of impacts during the construction and closure and reclamation phases would be temporary in duration; there would also be low intensity noise impacts associated with periodic and intermittent maintenance activities that would occur throughout the life of the project.

No vibration impacts during natural gas pipeline construction, operations, or closure and reclamation at the sensitive receptors are expected.

Table 3.9-32 compiles a summary of noise impacts associated with pipeline (mainline) construction, operations, and closure and reclamation activities under Alternative 2. Table 3.9-33 shows a summary of noise impacts associated with the pipeline above-ground facilities.

Table 3.9-32: Summary of Noise Impacts at Nearest Sensitive Receptor for the
Natural Gas Pipeline - Mainline

Subcomponent/ Activities	Nearest Sensitive Receptor	Receptor Distance (miles)	Project-related Noise Receptor (dBA L _{DN})	Ambient Noise Increase at Receptor (dBA L _{DN})
Construction				
Civil Construction and General Activities	Rainy Pass Lodge (Skwentna)	0.60	58	19
Drilling and Blasting	Farewell	2.26	35	2
Ice Road Construction and Maintenance	Farewell	1.90	48	10
Pipelaying	Rainy Pass Lodge (Skwentna)	0.60	58	19
River Crossing and HDD	Skwentna	8.69	25	1
Pipe Cleaning, Pressure Testing, and Drying	Rainy Pass Lodge (Skwentna)	0.60	46	8
Operations				
Pipeline Operations	Rainy Pass Lodge (Skwentna)	0.60	39	0
Periodic Pipeline Maintenance and Inspection	Rainy Pass Lodge (Skwentna)	0.60	46	8
Pipeline ROW Maintenance and Safety Inspection	Rainy Pass Lodge (Skwentna)	0.60	59	20
Closure and Reclamation				
Reclamation after Construction	Rainy Pass Lodge (Skwentna)	0.60	58	19
Reclamation at Pipeline Closure	Rainy Pass Lodge (Skwentna)	0.60	46	8

Notes:
dBA = A-weighted decibel
L_{DN} = Day-Night Sound Level

Table 3.9-33: Summary of Noise Levels at Nearest Sensitive Receptor for the Above-Ground Pipeline Facilities

Subcomponent/ Activities	Nearest Sensitive Receptor	Receptor Distance (Miles)	Project-related Noise at Receptor (dBA LDN)	Ambient Noise Increase at Receptor (dBA LDN)
Construction				
Compressor Station (MP 0.4)	Beluga	12.43	35	2
Metering Station (MP 315)	Crooked Creek	10.09	37	2
Mainline Block Valve Station (MP 156)	Farewell	7.90	38	3
Pig Launcher/ Receiver Station (MP 156)	Farewell	7.90	38	3
Operations				
Compressor Station (MP 0.4)	Beluga	12.43	30	1
Metering Station (MP 315)	Crooked Creek	10.09	29	1
Mainline Block Valve Station (MP 156)	Farewell	7.90	31	7
Pig Launcher/ Receiver Station (MP 156)	Farewell	7.90	31	7
Closure and Reclamation				
Compressor Station (MP 0.4)	Beluga	12.43	32	1
Metering Station (MP 156)	Crooked Creek	10.09	34	1
Mainline Block Valve Station (MP 156)	Farewell	7.90	36	7
Pig Launcher/ Receiver Station (MP 156)	Farewell	7.90	36	7

Abbreviations:
dBA = A-weighted decibel
LDN = Day-Night Sound Level

3.9.4.3.4 CLIMATE CHANGE

Predicted overall increases in temperatures and precipitation and changes in the patterns of their distribution have the potential to influence the projected effects of the Donlin Gold Project (discussed in Section 3.26.4). Climate change is not anticipated to influence the effects of the project on noise and vibration levels.

3.9.4.3.5 SUMMARY OF IMPACTS FOR ALTERNATIVE 2

For the sake of presenting the worst-case noise impacts on the community of Crooked Creek (being the nearest sensitive receptor to noise sources within the mine site neighboring areas) during construction, operations, and closure and reclamation, Table 3.9-34 shows the resulting combined noise levels due to project-related activities that could possibly occur at the same time during different phases of the project. The resulting combined noise levels at the sensitive receptor (Crooked Creek), including the existing ambient noise, would be 48 dBA to 49 dBA L_{DN} with noise increases at 9 dBA to 10 dBA L_{DN} compared to the existing ambient level. Therefore, noise impacts would be considered low in intensity (slightly detectable). The geographic extent of impacts would be local and common in context.

Table 3.9-34: Predicted Noise Levels at Crooked Creek¹ due to Project-related Activities that may Occur Simultaneously

Project Phase/Activity	Project Component	Receptor Distance (miles)	Project-related Noise at Receptor (dBA L _{DN}) ²	Combined Noise Levels (dBA L _{DN}) ³	Ambient Noise Increase at Receptor (dBA L _{DN}) ⁴
Construction					
Civil Construction	Mine Site	9.15	44	49	10
Surface Transportation - Mine Access Road and Material Sites	Transportation	5.93	42		
Air Transportation – Air Strip	Transportation	14.83	40		
Water Transportation – Angyaruaq (Jungjuk) Port Site	Transportation	5.94	42		
Metering Station (MP 315)	Pipeline	10.09	37		
Operations					
Mine Site Operations	Mine Site	9.15	45	49	10
Surface Transportation - Mine Access Road and Material Sites	Transportation	5.93	31		
Air Transportation – Air Strip	Transportation	14.83	40		
Water Transportation – Angyaruaq (Jungjuk) Port Site	Transportation	5.94	45		
Metering Station (MP 315)	Pipeline	10.09	29		
Closure and Reclamation					
General reclamation activities	Mine Site	9.15	38	48	9

Table 3.9-34: Predicted Noise Levels at Crooked Creek¹ due to Project-related Activities that may Occur Simultaneously

Project Phase/Activity	Project Component	Receptor Distance (miles)	Project-related Noise at Receptor (dBA L _{DN}) ²	Combined Noise Levels (dBA L _{DN}) ³	Ambient Noise Increase at Receptor (dBA L _{DN}) ⁴
Surface Transportation - Mine Access Road and Material Sites	Transportation	5.93	37	48	9
Air Transportation – Air Strip	Transportation	14.83	40		
Water Transportation – Angyaruaq (Jungjuk) Port Site	Transportation	5.94	45		
Metering Station (MP 315)	Pipeline	10.09	34		

Notes:

- Existing ambient noise level of 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) was assumed for the Crooked Creek.
- Project-related noise levels at receptor means the estimated noise levels at receptor location resulting from logarithmic combination of noise generated by project-related noise sources and existing point source ambient, but not including the receptor's existing ambient level.
- Combined noise levels include the existing ambient level and the project-related noise levels at receptor, calculated using the equation for adding unequal sound pressure levels in Section 3.9.4.1.
- Ambient noise level increase at a receptor means the arithmetic difference between future ambient noise level at the receptor location (estimated by logarithmic combination of project-related and existing receptor ambient noise levels) and existing ambient level.

Abbreviations:

dBA = A-weighted decibel
L_{DN} = Day-Night Sound Level

Overall, impacts of Alternative 2 on noise would be minor, with greater impacts felt at specific sensitive receptors during pipeline construction. The exact noise levels would depend on the number and type of noise sources operating at the same time from the same reference distance. For this project, noise impacts are generally more intense during the construction phase due to higher sound levels produced by heavy construction equipment. Because assumptions made on these analyses were based on conservative scenarios (nearest sensitive receptor, loudest equipment, full-time operations, maximum number of units operating simultaneously, and the like), it would be prudent to state that resulting noise levels on a sensitive receptor during actual project-related activities would be similar to or less than what was predicted for this study. Impacts on nearest sensitive receptor were evaluated independently according to type of activity for each project phase per project component.

Impacts would be of low intensity for the mine site and transportation facilities due to the distance from the mine site to the sensitive receptor (Crooked Creek). Higher intensity noise levels associated with construction, and operations and maintenance activities could be experienced at the Dutch Harbor Port for sensitive receptors located within 3,000 feet from the port sites; these impacts would be considered indirect. Higher intensity noise levels could also be experienced at Rainy Pass Lodge during pipeline construction, pipe laying and periodic pipeline maintenance; these impacts would be temporary and intermittent. The duration of

most noise effects would range from temporary (intermittent impacts associated with construction or closure and reclamation activities, or specific maintenance events) to long-term (e.g., somewhat perceptible changes in noise levels associated with mine site operations). The geographic extent of impacts would be local, in that impacts would be experienced at sensitive receptors. There are no unique resources, or resources protected by legislation at any of the sensitive receptors, so noise impacts would be considered common in context.

Many aspects of the project components and phases do not utilize major ground-borne vibration-causing equipment. For this study, vibration impacts during pile driving or blasting activities were analyzed as a conservative approach as this equipment is considered to produce major sources of ground vibration for the project. Impacts would be low in intensity at the sensitive receptors, and would be considered temporary in duration (vibration-causing activities would occur intermittently throughout project construction and operation). Net overall effects of Alternative 2 on vibration would be considered minor.

Table 3.9-35: Summary of Impacts to Noise for Alternative 2

Impact Type	Impact Level				
	Magnitude or Intensity	Duration	Geographic Extent	Context	Summary Impact Rating ¹
Mine Site					
Project-related noise at receptor (dBA L _{DN})	Low	Temporary to Long-Term	Local	Common	
Summary	Low	Temporary to Long-Term	Local	Common	Minor
Transportation Facilities					
Project-related noise at receptor (dBA L _{DN})	Low	Temporary to Long-Term	Local	Common	
Summary	Low	Temporary to Long-Term	Local	Common	Minor
Pipeline					
Project-related noise at receptor (dBA L _{DN})	Low to High	Temporary to Long-Term	Local	Common	
Summary	Low to High	Temporary to Long-Term	Local	Common	Minor

Notes:

1 The summary impact rating accounts for impact reducing design features proposed by Donlin Gold and Standard Permit Conditions and BMPs that would be required. It does not account for additional mitigation measures the Corps is considering.

As discussed above, these effects determinations take into account impact reducing design features (Table 5.2-1, Chapter 5, Impact Avoidance, Minimization, and Mitigation) proposed by Donlin Gold and also the Standard Permit Conditions and BMPs (Section 5.3) that would be implemented. Several examples of these are presented below.

Design features most important for reducing impacts to noise include how the project design includes the development and implementation of a Construction Communications Plan to inform the public and commercial operators of construction activities.

Standard Permit Conditions and BMPs most important for reducing impacts of noise would include the development of Blasting Plans.

3.9.4.3.6 ADDITIONAL MITIGATION AND MONITORING FOR ALTERNATIVE 2

The Corps is considering additional mitigation (Table 5.7-1, Chapter 5, Impact Avoidance, Minimization, and Mitigation) to reduce the effects presented above. These additional mitigation measures include:

- House compressors and electric motors in metal-framed and sided buildings with sound insulation designed into the wall thickness, as practicable. If practicable, use specially-quieted equipment such as quieted and enclosed air compressors and properly-working mufflers on engines; and
- Minimize use of an impact pile driver where practicable in noise and vibration-sensitive areas. Drilled piles or the use of a sonic or vibratory pile driver are quieter and cause lower vibration levels where the geological conditions permit their use.

If these mitigation and monitoring measures were adopted and required, the summary impact rating for the mine site, transportation facilities, and pipeline would be reduced, but would remain minor.

The Corps is not considering additional monitoring to reduce the effects presented above at this time.

3.9.4.4 ALTERNATIVE 3A – REDUCED DIESEL BARGING: LNG-POWERED HAUL TRUCKS

Alternative 3A involves replacing the diesel-powered haul trucks used in Alternative 2 with primarily LNG-fueled haul trucks. This alternative is considered with the assumption that ultra-class LNG-fueled haul trucks would be commercially available during the procurement of mining equipment for the project.

Under this alternative, the noise-producing equipment that would be operated, location of noise sources, sensitive receptors, and related activities conducted during the construction, operations, and closure and reclamation phases would be the same as those discussed under Alternative 2.

As a result, under Alternative 3A, the direct and indirect noise and vibration effects would be the same as for Alternative 2 (see Section 3.9.4.3). No impacts associated with climate change are expected for noise.

Design features, Standard Permit Conditions and BMPs most important for reducing impacts of noise are described in Alternative 2. Additional mitigation measures are also described in Alternative 2. If these mitigation measures were adopted and required, the summary impact rating would be similar to Alternative 2, minor.

3.9.4.5 ALTERNATIVE 3B – REDUCED DIESEL BARGING: DIESEL PIPELINE

Under Alternative 3B, a 334-mile, 18-inch diameter buried diesel pipeline would be constructed along the same alignment proposed for the natural gas pipeline in Alternative 2. No natural gas pipeline would be constructed under this alternative. Alternative 3B would include the construction and operation of an additional diesel pipeline segment, connecting the diesel fuel source at Tyonek to the proposed Alternative 2 pipeline route at MP 0 in Beluga. With respect to noise and vibration, there would be no substantial variation in heavy equipment utilization, location of noise sources and nearest sensitive receptors, or activities undertaken during the construction, operations, and closure and reclamation phases for each of the project components from what was discussed and analyzed in Alternative 2. Levels of seasonal river barging would be slightly reduced; however, assumptions for noise calculations and resulting noise levels would still be the same as discussed under Alternative 2. Noise and vibration effects resulting from this additional pipeline segment are described below.

3.9.4.5.1 TYONEK DIESEL PIPELINE SEGMENT

A 19-mile segment between Tyonek and the beginning of the natural gas pipeline route (under Alternative 2) at MP 0 in Beluga would be constructed for the diesel pipeline. This additional segment would cross the Beluga River using HDD.

Noise and vibration impacts methodology for the Tyonek diesel pipeline segment during the construction, operations, and closure and reclamation phases would be the same as the pipeline section described in Alternative 2. The equipment list shown in Table 3.9-28 and assumptions used in analyzing the noise and vibration impacts for the natural gas pipeline in Alternative 2 also apply to the noise and vibration impact analysis for the Tyonek diesel pipeline segment, with the following exceptions:

- The nearest sensitive receptors would be the communities of Tyonek and Beluga (0.40 miles and 0.95 miles away from the pipeline segment, respectively).
- There would be no blasting or ice road construction and maintenance activities associated with the Tyonek pipeline segment.

The following factors used in the noise and vibration impact analysis for the Tyonek diesel pipeline are common to the construction, operations, and closure and reclamation phases:

- The nearest sensitive receptors' existing ambient levels are estimated at 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA.
- The existing ambient noise level at the noise sources (point source) location is estimated at 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA.
- The geographic extent of the impacts would be considered local because impacts would be experienced at the sensitive receptors.
- The context of the impacts would be considered important. Although the noise sensitive receptors and noise sources would be located within the boundaries of the Susitna Flats State Game Refuge (SFSGR), a state-designated protected area, the communities of Beluga and Tyonek do not contain unique or legislatively-protected resources.

- No vibration impacts are expected as a result of construction, operation, or closure and reclamation activities at either sensitive receptor.

Peak noise levels at the sensitive receptor of Tyonek resulting from construction and reclamation activities, including the existing ambient noise, would be approximately 61 dBA L_{DN} , an increase of 22 dBA L_{DN} compared to the existing ambient level. There would be no change in existing ambient noise levels associated with HDD activities at Tyonek. While impacts during construction and reclamation activities would range from low to medium intensity, they would be temporary in duration, and would occur intermittently throughout these two phases. During pipeline operations, impacts would be long-term, but would not create a perceivable change in the existing ambient noise levels. Intermittent maintenance activities would produce higher intensity impacts.

Peak noise levels at the sensitive receptor of Beluga resulting from construction and reclamation activities, including the existing ambient noise, would be approximately 54 dBA L_{DN} , an increase of 15 dBA L_{DN} compared to the existing ambient level. While impacts related to construction and reclamation activities would range from low to high intensity, they would be temporary in duration, and would occur intermittently throughout these two phases. During HDD activities, noise levels at Beluga (including ambient noise) would be approximately 40 dBA L_{DN} , an increase of 1 dBA L_{DN} compared to the existing ambient level. This noise level would not create a perceivable change in the existing ambient noise level. During pipeline operations, impacts would be long-term, but would not create a perceivable change in the existing ambient noise levels. Intermittent maintenance activities would produce higher intensity impacts.

Noise and vibration impacts analyses for the Tyonek dock upgrade and diesel shipments under Alternative 3B used the same methodology and assumptions for the Bethel Port noise and vibration impacts analyses under Alternative 2; therefore, increase in noise and vibration levels resulting from construction and operations activities at the Tyonek facility would be similar to the Bethel Port subcomponent under Alternative 2.

3.9.4.5.2 SUMMARY OF IMPACTS FOR ALTERNATIVE 3B

Under Alternative 3B, noise impacts would be considered minor. Although there would be a reduction in the amount of noise generated due to diesel shipping and trucking under Alternative 3B, the sensitive receptors are located far enough away from the noise sources that impacts would be considered similar to Alternative 2. The magnitude of impacts at the sensitive receptors of Tyonek and Beluga would range from low to high intensity, mostly driven by the type of activity that would occur. Detectable changes in noise levels would primarily occur during civil construction and closure and reclamation activities; intermittent pipeline maintenance would also produce higher intensity impacts, but would occur approximately once every 10 years. Impacts would primarily be temporary in duration and intermittent (not occurring continuously at the same location), lasting for short periods only (about 3 to 4 months per pipeline section) through the construction and closure and reclamation phases. The extent of impacts would be local (perceived at the sensitive receptor), and important in context. Although the sensitive receptors and noise sources would be located within the boundaries of the SFSGR, a state-designated protected area, the communities of Beluga and Tyonek do not contain unique or legislatively-protected resources. No impacts associated with climate change are expected for noise.

Design features, Standard Permit Conditions and BMPs most important for reducing impacts of noise are described in Alternative 2. Additional mitigation measures are also described in Alternative 2. If these mitigation measures were adopted and required, the summary impact rating would be similar to Alternative 2, minor.

3.9.4.6 ALTERNATIVE 4 – BIRCH TREE CROSSING (BTC) PORT

This alternative moves the upriver port site from Angyaruaq (Jungjuk) under Alternative 2 to BTC, located approximately 69 river miles below the Angyaruaq (Jungjuk) Port site. In addition, a new 76-mile access road (BTC Road) between the BTC Port site and the mine site would be used for transporting fuel and cargo for the project as shown in Figure 2.3-42, Chapter 2, Alternatives. This alternative would include similar port and road construction techniques as those described for Alternative 2, in addition to maintenance and closure and reclamation activities. An exception would be the development of a single season temporary ice road from the mine site to the vicinity of the village of Crooked Creek. The temporary ice road would support construction of the BTC Road from opposing ends.

Noise and vibration impacts analyses methodology for the BTC Port site and BTC Road would be the same as what was utilized for the Angyaruaq (Jungjuk) Port site and mine access road, respectively, during the construction, operations, and closure and reclamation phases under Alternative 2. The nearest sensitive receptor would be the City of Aniak, located 10.7 miles from the BTC Port site and 5.2 miles from the BTC Road.

The following factors used in the noise and vibration impact analysis are common to all phases of the BTC Port site and BTC Road subcomponents:

- The existing ambient noise levels at the nearest sensitive receptor (Aniak) are estimated at 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA.
- The existing ambient noise level at the noise sources (point source) location is estimated at 39 dBA L_{DN} (adapted from Table 3.9-2 for Rural Residential) and L_{EQ} estimated at 33 dBA.
- Noise-producing activities at the point sources being analyzed are assumed to occur at their peak levels; i.e., during the 110-summer-day shipping season.
- Noise levels do not include noise from aircraft traffic. Flight routes and vertical aircraft distances are unknown at this time; resulting noise levels during a fly-over at the nearest sensitive receptor could not be estimated. Any noise generated from aircraft fly-overs would be temporary and transient.
- The geographic extent of impacts would be considered local because any impacts would be experienced at the nearest sensitive receptor.
- The context of noise impacts would be considered common. The sensitive receptor and point source locations do not contain unique or legislatively-protected resources.
- No vibration impacts are expected at the sensitive receptor.

Project-related noise levels at the sensitive receptor of Aniak would create a barely-perceptible to no perceivable change in the existing ambient noise levels (Table 3.9-36). Impacts would be

low in intensity and temporary (during construction and closure and reclamation) in duration. Any impacts during the operations phase would be long-term, lasting through the duration of the project, but intermittent in nature. Although the BTC Port site and BTC Road would both remain in use after project closure, any noise impacts produced would be similar to, or below the noise levels generated during operations and, therefore, would not create a perceivable change in existing ambient noise levels in Aniak.

3.9.4.6.1 SUMMARY OF IMPACTS FOR ALTERNATIVE 4

The construction, operations, and closure and reclamation activities of the Donlin Gold Project under Alternative 4 would result in slightly less intense noise impacts compared to Alternative 2. Alternative 4 would eliminate barge-related noise in the stretch of river between BTC Port and Angyaruaq (Jungjuk) Port; however, the nearest sensitive receptors for this alternative would not be impacted by the reduction in noise levels. Overall, impacts of Alternative 4 on noise levels would be negligible. Vibration impacts at the nearest sensitive receptors would be no effect or negligible. No impacts associated with climate change are expected for noise.

Table 3.9-36: Summary of Noise Impacts at Nearest Sensitive Receptor for Alternative 4

Subcomponent/ Activities	Nearest Sensitive Receptor	Receptor Distance (miles)	Project-related Noise at Receptor (dBA L _{DN})	Ambient Noise Increase at Receptor (dBA L _{DN})
BTC Port Site				
Construction	Aniak	10.7	36	2
Operations	Aniak	10.7	39	3
Closure and Reclamation	Aniak	10.7	29	0
BTC Road				
Construction	Aniak	5.2	43	5
Operations	Aniak	5.2	35	2
Closure and Reclamation	Aniak	5.2	39	3

Notes:
dBA = A-weighted decibel
L_{DN} = Day-Night Sound Level

Design features, Standard Permit Conditions and BMPs most important for reducing impacts of noise are described in Alternative 2. Additional mitigation measures are also described in Alternative 2. Overall, impacts of Alternative 4 on noise levels would be negligible. Vibration impacts at the nearest sensitive receptors would be no effect or negligible. Therefore, if these mitigation measures were adopted and required, the summary impact rating for Alternative 4 would still have no effect or be negligible.

3.9.4.7 ALTERNATIVE 5A – DRY STACK TAILINGS

Alternative 5A would use the dry stack tailings method instead of the subaqueous tailings storage method utilized under Alternative 2. This alternative tailing method does not change

any previously described Alternative 2 noise or vibration impacts. Noise-producing equipment operated, location of noise sources, sensitive receptors, and related activities conducted during construction, operations, and closure and reclamation phases would be the same as those analyzed in Alternative 2 (Section 3.9.4.3). No impacts associated with climate change are expected for noise.

Design features, Standard Permit Conditions and BMPs most important for reducing impacts of noise are described in Alternative 2. Additional mitigation measures are also described in Alternative 2. If these mitigation measures were adopted and required, the summary impact rating would be similar to Alternative 2, minor.

3.9.4.8 ALTERNATIVE 6A – MODIFIED NATURAL GAS PIPELINE ALIGNMENT: DALZELL GORGE ROUTE

The construction, operation, and closure and reclamation of the mine site and transportation facilities under this alternative would result in similar direct and indirect impacts to noise as discussed previously under Alternative 2. No impacts associated with climate change are expected for noise. There would be no substantial variation in heavy equipment utilization, location of nearest sensitive receptors, or activities undertaken during the construction, operation, and closure and reclamation related to the natural gas pipeline resulting from the Dalzell Gorge route. See Section 3.9.4.3 for detailed discussion on noise and vibration impacts.

Design features, Standard Permit Conditions and BMPs most important for reducing impacts of noise are described in Alternative 2. Additional mitigation measures are also described in Alternative 2. If these mitigation measures were adopted and required, the summary impact rating would be similar to Alternative 2, minor.

3.9.4.9 COMPARISON OF IMPACTS – ALL ALTERNATIVES

A comparison of the noise impact project components by alternative is presented in Table 3.9-37. A summary of noise impacts at nearest sensitive receptors for Alternative 2 can be found in Table 3.9-19 (mine site), Table 3.9-27 (transportation facilities), Table 3.9-32 and Table 3.9-33 (pipeline). A summary of noise impacts at the nearest sensitive receptor for Alternative 4 is found in Table 3.9-36. Noise impacts summaries for each of the other Alternatives are as described in Sections 3.9.4.4 through 3.9.4.8, respectively.

Table 3.9-37: Comparison of Impacts by Alternative*

Impact-causing Project Component	Alt. 2 – Proposed Action	Alt. 3A – LNG-Powered Haul Trucks	Alt. 3B – Diesel Pipeline	Alt. 4 – BTC Port	Alt. 5A – Dry Stack Tailings	Alt. 6A – Dalzell Gorge Route
Mine Site						
Construction	Heavy equipment operations at the mine site during initial pioneering and development of mine pits and construction of mining facilities, milling facilities, tailings, waste rock, overburden storage facilities, haul roads, and support infrastructure	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
Operations	Industrial-type heavy equipment used for extracting material from the ground, transporting ore, overburden, and waste rock; blasting; mining and milling processes; and maintenance of support facilities and infrastructure	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
Closure and Reclamation	Industry-standard heavy equipment operations during earthwork activities upon final mine closure and concurrent reclamation activities	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
Summary Impact Level	Minor	Minor	Minor	Minor	Minor	Minor

Table 3.9-37: Comparison of Impacts by Alternative*

Impact-causing Project Component	Alt. 2 – Proposed Action	Alt. 3A – LNG-Powered Haul Trucks	Alt. 3B – Diesel Pipeline	Alt. 4 – BTC Port	Alt. 5A – Dry Stack Tailings	Alt. 6A – Dalzell Gorge Route
Transportation Facilities						
Construction	<p><u>Surface Transportation:</u> Heavy equipment operations during construction of a 30-mile long mine access road</p> <p><u>Air Transportation:</u> Construction equipment operations during construction of the airstrip and associated facilities; noise from passenger and cargo aircrafts</p> <p><u>Water Transportation:</u> Construction equipment operations during ground preparation and development of the Angyaruaq (Jungjuk) Port, construction of cargo terminal and fuel storage at the Bethel Port site, possible construction of fuel storage facilities at the Dutch Harbor Port site, cargo and fuel barge traffic during construction phase</p>	Same as Alternative 2	Same as Alternative 2	<p><u>Surface Transportation:</u> Heavy equipment operations during construction of the 76-mile BTC Road</p> <p><u>Air Transportation:</u> Same as Alternative 2</p> <p><u>Water Transportation:</u> Same as Alternative 2 except Angyaruaq (Jungjuk) Port is replaced by BTC Port</p>	Same as Alternative 2	Same as Alternative 2
Operations	<p><u>Surface Transportation:</u> Cargo and fuel trucks, pickup trucks and bus transportation along the mine access road</p> <p><u>Air Transportation:</u> Passenger and cargo aircrafts, and two generators</p> <p><u>Water Transportation:</u> Transport equipment, vehicles and power generators used during port operations and maintenance activities at the port sites (Angyaruaq [Jungjuk], Bethel, and Dutch Harbor); barge traffic in Kuskokwim River</p>	Same as Alternative 2	Same as Alternative 2	<p><u>Surface Transportation:</u> Same as Alternative 2 except mine access road is replaced by BTC Road</p> <p><u>Air Transportation:</u> Same as Alternative 2</p> <p><u>Water Transportation:</u> Same as Alternative 2 except Angyaruaq (Jungjuk) Port is replaced by BTC Port</p>	Same as Alternative 2	Same as Alternative 2

Table 3.9-37: Comparison of Impacts by Alternative*

Impact-causing Project Component	Alt. 2 – Proposed Action	Alt. 3A – LNG-Powered Haul Trucks	Alt. 3B – Diesel Pipeline	Alt. 4 – BTC Port	Alt. 5A – Dry Stack Tailings	Alt. 6A – Dalzell Gorge Route
Closure and Reclamation	<p><u>Surface Transportation:</u> During closure, impacts would be same as operations and maintenance (mine access road would remain as a long-term asset after the end of mining); for subsequent reclamation after construction, heavy equipment used to perform earthwork to reclaim 11 borrow pits</p> <p><u>Air Transportation:</u> Same as operations and maintenance (airstrip would remain as a long-term asset after the end of mining)</p> <p><u>Water Transportation:</u> Same as operations and maintenance for the port sites (the ports would be utilized for post-mining reclamation and closure activities and would remain as a long-term asset after the end of mining), reduced barge traffic in Kuskokwim River</p>	Same as Alternative 2	Same as Alternative 2	<p><u>Surface Transportation:</u> Same as Alternative 2 except mine access road is replaced by BTC Road</p> <p><u>Air Transportation:</u> Same as Alternative 2</p> <p><u>Water Transportation:</u> Same as Alternative 2 except Angyaruaq (Jungjuk) Port is replaced by BTC Port</p>	Same as Alternative 2	Same as Alternative 2
Summary Impact Level	Minor	Minor	Minor	Minor	Minor	Minor
Pipeline						
Construction	Heavy equipment operations during construction of Mainline (includes the 315-mile pipeline, ROWs, and temporary work areas (access roads, construction camps, pipe and equipment storage yards, material sites, and airstrips); and above-ground facilities (compressor station, main line block valve stations, metering stations, and pig launching and receiving facilities) extending from BPL to Donlin Gold mine site	Same as Alternative 2	Same as Alternative 2, but would include construction of the 19-mile Tyonek diesel pipeline segment, Operations Center, and Pumping Facility	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

Table 3.9-37: Comparison of Impacts by Alternative*

Impact-causing Project Component	Alt. 2 – Proposed Action	Alt. 3A – LNG-Powered Haul Trucks	Alt. 3B – Diesel Pipeline	Alt. 4 – BTC Port	Alt. 5A – Dry Stack Tailings	Alt. 6A – Dalzell Gorge Route
Operations	<p><u>Mainline:</u> In-line inspection tools (pigs) operated during periodic maintenance and routine inspection activities on the mainline; equipment operated during ROW clearing at approximately 10-year intervals</p> <p><u>Above-Ground Facilities:</u> Compressor Station (MP 0.4): two compressor machines and electric motors, fin-fan coolers, blowdown processes, and pipeline pig(s)</p> <p><u>Metering Stations:</u> Collocated with a pig launcher (MP 0) and receiver (MP 315)</p> <p><u>Mainline Block Valve Stations:</u> Collocated with pig launcher/ receiver (MP 0, 156, and 315) and the compressor station (MP 0.4)</p>	Same as Alternative 2	Same as Alternative 2, but would include operations and maintenance of the 19-mile Tyonek diesel pipeline segment, Operations Center, and Pumping Facility	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
Closure and Reclamation	<p><u>Mainline:</u> Noise from helicopter traffic, purging of natural gas by pigging with a cleaning pig, and from small hand tools used to cut aboveground sections of the pipeline</p> <p><u>Above-Ground Facilities:</u> Heavy equipment used to perform earthwork and tools to dismantle equipment in the facilities</p>	Same as Alternative 2	Same as Alternative 2 but would include reclamation activities for the 19-mile Tyonek diesel pipeline segment, Operations Center, and Pumping Facility	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
Summary Impact Level	Minor	Minor	Minor	Minor	Minor	Minor

Notes:

* Alternative 1 (No Action Alternative) would have no impacts to noise and vibration levels.